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CINCINNATI, OHIO

APRIL, 1939

VOL. 11, No. 11

Practical Heat Treating

The first article of a series in which the more important factors in modern heat treatment will be discussed.

This article deals with Carburizing.

By FREDERICK TAYLOR POTTER

DURING the past few years a great deal has been written on the subject of heat treatment, much of it highly technical and the balance so insufficiently detailed as to be of little assistance to the practical man in making or operating an installation of heat treating equipment. It will therefore be the aim of this and succeeding articles to fill the gap and to provide certain non-technical details intended to be of use and interest. The suggestions that will be offered are drawn from practical experience and have been proved in actual use. The wearing qualities of most steel parts can be increased to the desired degree by the formation of a hard surface over a softer and tougher core, thus producing, practically, the wear resistance of hardened carbon

tool steel without its brittleness and higher cost.

For many such parts, cold drawn Bessemer screw stock or hot rolled machinery steel are commonly used. These steels are satisfactory for use in many screw machine parts and others where uniform hardness are not vital, but for the more exacting steady production work where a high quality of case and hardness are necessary, a steel such as S.A.E. X1315, which is especially designed for case hardening, should be used. Such steels are strictly normal, will develop excellent, hard cases without soft spots, will machine well, and are only slightly more expensive than screw stock or machinery steel. They are well worth the difference.

For parts that need greater

strength, steels containing alloying elements that develop strength are used. Among these steels are several similar to S.A.E. 3115 or 4615 which are heat treated in much the same way as those already mentioned. Their use is recommended for shafts and like parts that are subject to heavy loads or repeated stresses in different directions.

There are so many kinds of steels used for carburizing, and such a variety of treatments, that only typical examples will be given here. Detailed information as to the temperatures for specialized steels may be easily obtained from their manufacturers or from readily - available charts. In general, plain low carbon steels like S.A.E. 1020, X1315 or X112 should be carburized at 1,600-1,650 deg. F. for a time sufficient to produce the desired case depth. The low carbon alloy steels should be heated to a point about 50 deg. F. lower. For light cases of about 0.015 in., 1,525-1,550 deg. F. is better because the carburizing rate is slower and, therefore, is easier to stop at the desired point. Quenching direct from the container at 100 deg. F. lower than the carburizing temperature will produce satisfactory hardness but rather large size grain, which results in some loss of strength. However, such loss of strength may not be detrimental in certain parts not subject to much stress.

A very common method of treatment is to carburize as described



Frederick Taylor Potter

After graduating from Harvard University, in 1924, Mr. Potter spent nine years in the machine tool business. During this time he obtained patents on multi-speed reduction gears and gas combustion devices. Since 1933 he has been connected with the textile industry, the past four years as assistant superintendent of Whittin Machine Works. In this position he has had supervision of heat treating, forging, and a number of machine departments.

above, remove the pots from the furnace, and allow them to cool on floor. The parts are then reheated 1,480-1,500 deg. F. in lead, salt oven furnace about one hour for each inch of cross section. Quench in water for S.A.E. 1020 or X112, in oil for X1315 and the alloy steels.

Use oil for parts of the first two steels if they are particularly subject to distortion.

For the best condition of case and core, the recommended treatment is untempered. This method consists of carburizing at about 1,600 deg. F., cooling in the pot, reheating to 1,600 deg. F. for the plain carbon steels or 1,525-1,550 deg. F. for the alloys and quenching in oil. This treatment refines the core structure to a maximum strength. Parts are then reheated to 1,450 deg. F. and quenched, in water or brine for S.A.E. 1020 or X112, and in oil for X1315. Alloy steels should be heated to about 1,500 deg. F. and quenched in oil. This treatment refines the case structure without affecting the core, due to its higher critical point.

Tempering of carburized work to relieve strain or increase toughness should be done at about 300-325 deg. F. for the former and up to 400 deg. F. for the latter. Higher temperatures will materially decrease the hardness.

Cooling in the pot and then giving the work a single reheat as in the first method mentioned above is necessary where parts are to be hardened other than all over. The heating can be done in lead or

from the furnace to cool on the floor. After reheating, lead, salt, or other material may be formed fairly satisfactorily by copper plating or coating with special refractory paints the sections where carburizing is not desired. In subsequent hardening of the piece as a whole, these coated sections will not be affected if they have been properly treated.

Carburizing can be accomplished by several different methods: by packing the work in carbonaceous material in sealed containers which are then heated in an oven type furnace; by revolving the work in the retort of a rotary furnace, using carbonaceous material or gas as carburizers; by packing in baskets or fixtures in the retort of a vertical furnace using gas or cracked oil as a carburizer or by running through a conveyor furnace using gas as the carburizer. Bath casehardening will be taken up later.

The containers used in the packing method should be designed with the size of work and ease of handling as well as pot-shape and material in mind. If each pot is to contain one workpiece, it should be of such size as to allow $1\frac{1}{2}$ in. of packing material to be put in all around it. Since all of the materials shrink on heating, particularly the first time, the pot should be at least twenty per cent deeper than would otherwise be necessary. If miscellaneous small parts are to be packed, the size of the boxes is not important except from the standpoints of handling and long life, for both of which it is of advantage to have the boxes small. Another advantage of small boxes is that the work will be more uniformly heated, which is important where accurate-controlled case depths are required.

Most of the alloy casting manufacturers have standard size boxes,

the designs of which have been tested in use. It is suggested that a box 12 x 8 x 12 in. deep with a close fitting cover of the small alloy material is practical equipment for small parts. The general shape of such a box is shown in Fig. 1. A long-handled fork supported by two small wheels will be found useful for handling these and other pots in and out of the furnace. In this size a box of the proper alloy may be expected to have 3,500 to 5,000 heat-hours of life. At this rate the alloy will be found more economical than cast iron

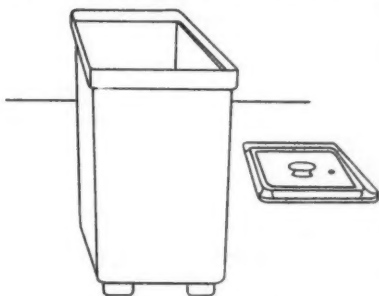


Fig. 1—Carburizing Pot.

or welded carbon steel in which the original investment is much lower. Pots of carbon steel or cast iron will give satisfactory service up to about 250 hours and will cost perhaps 12 cents per pound finished as against 90 cents per pound for a welded alloy steel or cast alloy iron box. As they near their breakdown point, pots of the unalloyed materials will lose their shape, covers will fit poorly, and air will leak in, causing faulty carburizing. In addition, pots of these plain materials have much less strength at elevated temperatures than the alloys and must be considerably heavier in order to endure for a satisfactory term of service. Therefore, more time and fuel are required to heat them. In selecting alloy steel for this service, one with 24 per cent chromium and 11 per

cent nickel will give good results, while in alloy iron one with 38 per cent chromium and 18 per cent nickel can be recommended.

Usually, boxes of cylindrical shape have the longest life. Tubes up to three or four feet in length, clamped together in groups so that they can be handled as a unit, will give good results on shafts. Such a container, with tubes of steel pipe or cast iron and clamped in a cast iron frame as illustrated in Fig. 3, is not expensive to make. Another inexpensive pot

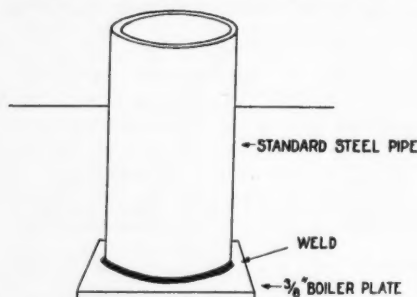


Fig. 2—Carburizing Pot made from steel pipe welded to a base of boiler plate.

may be made by welding the required length of six or eight-inch steel pipe to a square base of boiler plate cut slightly larger. This pot can readily be handled in the vertical position. To insure low leakage of the carburizing gas, all boxes should be so arranged that they may be luted or sealed after packing with fireclay or tight covers.

Carburizing compound has now largely taken the place of bone chips and other materials formerly used for the purpose. It has several advantages; greater uniformity of carburizing ability, very rapid action, and lower cost. It costs less to use because it is much lighter than bone and is "bought by weight while used by volume." It does, however, shrink somewhat more during its first use.

Allowance must be made for the waste when packing the work. Another economy is the fact that it may be entirely used up, the only part to be discarded being the dust at the bottom of the pile. By allowing the pile to stand in a dry place for a week or so before being used again, it will regenerate itself and may be used repeatedly.

Some compounds contain chemical energizers which tend to corrode alloy pots, the corrosion taking the form of a green deposit around the top. Should it appear, the use of that carburizer should be discontinued, since it will eventually destroy the pots. In storing any compound it is essential that it be kept in a dry place, otherwise it will quickly pick up moisture, resulting possibly in soft spots in finished work.

Where parts requiring cases of varying depths are carburized in the same furnace load, some method of time control is necessary. A simple way is to insert a short length of 1/2 in. cold drawn rod through a small hole in the pot cover, allowing several inches to protrude. At the end of the estimated time it may be pulled out and quenched in water. Comparison of the case with the specified will indicate whether the load should be quenched at once or allowed to remain longer in the heat.

In addition to automatic temperature control, a simple electric time clock of the type that costs about \$30.00 will be found useful on electric furnaces, permitting occasional jobs to be done during the night which would otherwise have to wait until the following day. This is a particularly valuable feature for tempering furnaces.

Practically any type of oven furnace will give good results on this operation, the size of the furnace depending on the size and amount of work. Oil-firing is usually the least

expensive, except where gas may be used at a very low rate. Since furnace atmosphere for this class of work is not important, it requires no special mention. Automatic temperature control is very desirable and should be installed if any amount of this work is to be done.

Rotary carburizing furnaces may be heated by gas, oil or electricity and are very economical for use on such parts as will not be damaged by the tumbling action of the retort and the distortion due to mass quenching. The high carbon case may be produced by the action of one, compound or a suitable gas. With any one of the three the ac-

tion is very rapid due to quick, uniform heating and the elimination of heating excess dead weight.

For most work, some sort of cushion is desirable to prevent marking in the retort. Such a cushion is provided by the use of compound or bone and at the same time accomplishes the carburizing at a rate which can be bettered but little by the introduction of gas as well. A load of four hundred pounds of small screws or nuts can be given a 1/64-in. case in about 1½ hours after the furnace reaches 1,400 deg. F. as it rises to its setting of 1,650 deg. F. In fact, the action is so rapid that it may be difficult to stop at the correct point on light case work.

Since it is difficult to take test samples from a furnace of this type, it is desirable to equip the furnace with a recording controller so that accurate timing is possible. The charts may be kept as records to provide information for the future. The alloy retort of such a unit is

expensive, so a non-indicating, non-recording controller with a thermocouple in the combustion chamber is needed for regulating the maximum temperature outside the retort to prevent disastrous overheating.

A rotary is a most productive unit, handling two or even three capacity light case loads per eight-hour shift. To quench this amount of steel requires adequate facilities. For a furnace rated at 700-pound capacity per charge, oil and water tanks at least

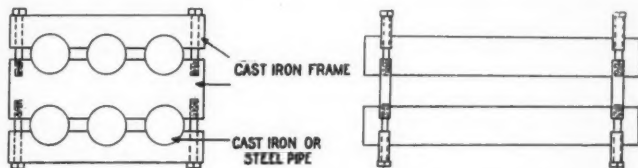


Fig. 3—Cylindrical Carburizing Pots clamped in a cast iron frame.

three feet square and three feet deep are needed. These should be of ¼-in. boiler plate with welded seams and should be sunk flush in the floor with their nearest edges about four feet from the furnace to provide the proper angle for the chute. They should be set side by side and fitted with steel covers of light non-slip floor plate reinforced with angle iron, hinged at their outside edges. An even better way is to make two pieces of each cover and hinge at both sides. They may then be used separately and can be walked upon when they are closed.

With oil quenching, the whole area is likely to become slippery, so non-slip steel is a good safety measure. Both tanks should be fitted with heavy mesh baskets or containers of perforated metal which can be lifted out by means of chain falls or hoists suspended from overhead rails or from an I-beam boom. This arrangement allows one hoist to serve both tanks and also handle the furnace

door, which is heavy and awkward to manipulate when hot. If this door is fitted with a three-foot rod in the middle of its outside end or has a projection on which a three-foot length of pipe can be applied when it is being opened or closed, one man can manage it.

The water tank should be supplied with a good flow of water from at least a two-inch pipe in the center of the bottom and should have a four-inch overflow. This will give excellent agitation while quenching. Do not use compressed air for agitation in any quench tank.

The oil tank should have similar intake and overflow connections. An effective and simple cooling system which will handle 400 to 500 lbs. per hour can be made by connecting the overflow (protected by a wire screen) to a twin strainer, from the strainer to a larger cooler in which the oil flows through tubes surrounded by a water jacket, and thence to a pump and back to the tank.

If the pump is within 10 feet of the overflow level, a motor-driven centrifugal of 25-30 g.p.m. will give sufficient cooling. A higher lift will probably require a gear pump to give satisfaction. For the water circulation in the oil cooler, the city service will be adequate or if a source such as a pond is used, a centrifugal pump slightly smaller than the size indicated will work well with a lift of not much over 10 feet.

A light but strong chute which can easily be directed to one tank or the other is necessary. If varying sizes of work are handled, it will be found convenient to have the frame built to receive interchangeable screens of several different meshes. The larger the mesh of the screen, the less compound will get into the tanks. The mesh should run as near as possible to the edges of the frame so that long, slender parts like pins will not

collect at the sides and miss the quench.

The chute will need a collar at the top which will extend about half way around the mouth of the retort when in dumping position. Since the retort is usually revolved while being dumped, the parts and compound will travel part way up with it before falling out and will miss the chute if they are not guided into it. A chute 18 in. wide will be adequate for most work. The only other tools needed are two light, strong hoes with steel handles 6 ft. long with which to assist the dumping and to control the flow of work down the chute. Fig. 1 shows the arrangement of such an installation.

The possibilities of a rotary furnace are great, and warrant consideration for many kinds of production work. The use of the rotary furnace is limited only by the size of the work and the condition of its outside surfaces. Pieces up to two pounds in weight may be handled without serious marking if they are to be ground all over afterwards, while those with delicate surfaces, such as threads, can safely be done if they do not weigh over half a pound each.

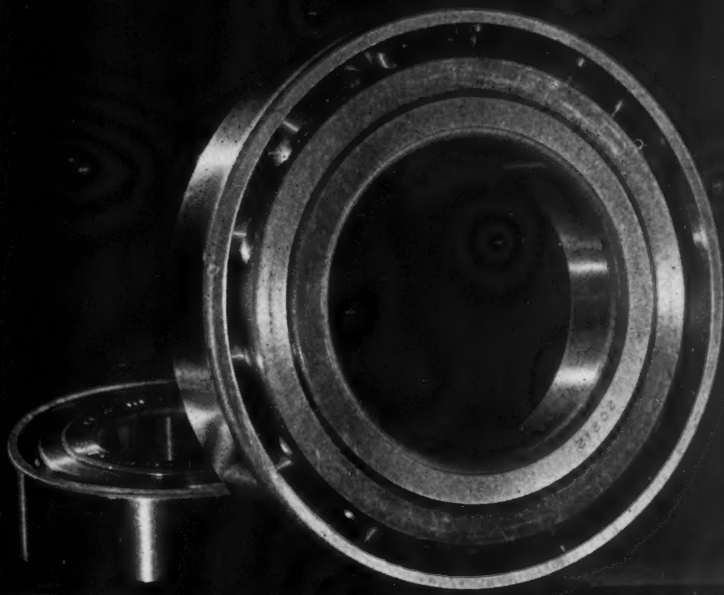
Long, slender shafts are likely to distort badly if they are quenched in a mass and so must be handled individually in that operation. In any case, a protective cushion of carburizing material is advisable in the proportion of 40 to 50 lbs. to each 500-lb. charge.

Vertical carburizing furnaces mounted in pits in the floor are very convenient for certain kinds of work; particularly, small pieces which may be packed in baskets or fixtures and handled by means of hoists. It has an advantage over the rotary method in that the work is not marked except, possibly, in the quench. Furnaces may be heated by oil, gas or electricity and the carburizing pro-

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formed by a gas such as propane, mixed with air or by cracked oil of special composition.

Uniformity of case-depth is secured by using a sealed cover which allows a pressure to be built up within the retort, or by means of a circulating fan. Excellent results may be obtained by a combination of the two, together with a high rate of carburization. In designing work-holding fixtures, alloy steel of the 24-11 type mentioned before should be used, bearing in mind the necessity for free circulation of the gas and for a convenient way of dumping the fixtures or quenching them along with the work. Quench tanks and a cooling system such as described above will be satisfactory.

The usefulness of vertical furnaces is limited by the necessity for perfect gas circulation and the difficulty of handling heavy loads in the quench.

Continuous carburizing requires highly specialized equipment, and since its use is limited to the high production of parts requiring practically the same case and depends for its economy on the handling of tremendous quantities of work, a brief description will suffice.

Such units may be of the belt conveyor type in which the work is carried on an endless alloy belt, or of the pusher variety in which the work is placed on trays and is advanced through the furnace by a mechanical or hydraulic pushing device. The

pusher is the better adapted to heavy work which would raise the loading of an alloy belt beyond the safe point.

With such furnaces the work may be quenched, washed and tempered, if desired, making the entire operation automatic and requiring a minimum of labor. They may be electrically heated or fired by gas or oil.

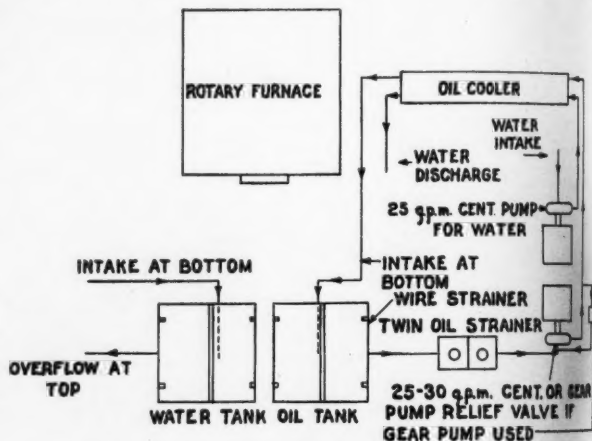


Fig. 4—Layout for Rotary Carburizing Furnace and Accessory Equipment.

the first two being the common ways. The work is usually carried through an alloy muffle with a "valve" at each end to exclude air or else the combustion is made to take place within radiant tubes, the ends of the furnace being equipped with "valves." Electric equipment requires no muffle but needs means for control of the air at the ends of the work-passage.

Carburizing action is secured by the introduction of a mixture of a hydrocarbon gas like propane with air in definite proportions. It is necessary that this be accurately controlled as to proportion and uniformly applied to the various sections of the furnace if satisfactory results are to be had.

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Limitations of this method are its very high first cost, the necessity for having a large production of similar parts and inflexibility compared to batch-type equipment. Continuous furnaces are at their best under steady operating conditions with large volume such as found in automotive work.

The above are the usual ways in which some of the light case and practically all of the 1/32 in. or deeper case work is done. The increasingly popular bath carburizing for medium depth cases and the widely used cyanide and activated baths for light cases, as well as the subject of nitriding, will be discussed in another paper.

Physics of Metal Cutting. By Hans Ernst. Published and distributed by The Cincinnati Milling Machine Company, Cincinnati, Ohio.

This 34-page booklet comprises a reprint of a lecture presented by Hans Ernst at the National Metal Congress held under the auspices of the American Society for Metals at Detroit, October 17-21, 1938. The author is Director of Research, Cincinnati Milling Machine and Cincinnati Grinders, Inc. In his lecture, Mr. Ernst begins with the older theories and conceptions of metal cutting tool action and leads into a discussion of his laboratory findings. He explains the behavior of metal in flowing under a flat-faced punch, and then shows, by means of moving pictures, how the metal flows under the pressure of a cutting tool. The motion pictures, taken through a microscope, show the formation of the chip on the cutting point, the compression of the chip, and the escape of the chip as the pressure is continued.

The book presents illustrations of the motion picture camera set up to take pictures of the chip flow under the microscope, sections from the moving picture film, photomicrographs showing cross sections of the chip and workpiece, microscopic views taken from the film showing the actual formation of the chip, and behavior of the metal in action. Here, probably for the first time, are presented photographs and descriptions of what actually takes

place at the point of the cutting tool. Copy free to any mechanical executive.

"Cutting Fluids," a 16-page illustrated booklet published by the Tide Water Associated Oil Company, is a comprehensive presentation of cutting fluids and their applications, from light automatic screw machine work to heavy broaching. Various types of cutting operations are classified and the functions of the cutting fluids involved are given in detail.

The booklet explains the need for a cutting fluid correct for the metal being cut and the machining operation involved if optimum results are to be secured. Schematic drawings illustrate the correct and incorrect methods of applying oil to the cutting operation.

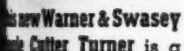
In the discussion on Tycol transparent, non-tarnishing sulphurized cutting oils, recommended operations for the application of each oil are outlined. Also discussed in this section are other cutting oils, such as soluble oils, mineral oils and fatty oils, said to satisfy practically every condition encountered in the machining of all classes of metals.

The concluding section of the booklet is devoted to chemical composition tables of various alloy steels, as well as an explanation of the S.A.E. steel numbering system. Copies of this booklet may be obtained by writing to the Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

"Bay State" Grinding Wheels. A complete catalog and price list covering the line of grinding wheels made by Bay State Abrasive Products Company, Westboro, Mass., is available from this company. Wheels listed include vitrified and silicate bonded, shellac bonded, rubber bonded, and resinoid bonded. A section is given over to other Bay State products — coping wheels, rubbing bricks, cylinder honing sticks, jointer stones, railway track bricks, and rail scouring bricks.

Tungsten Carbide Work Support Blades for use on Cincinnati Nos. 2, 3 and 4 Centerless Grinding Machines are featured in a four-page folder issued by Cincinnati Grinders Inc., Cincinnati, Ohio. These blades are generally suitable for the centerless grinding of most materials 1/8-in. diameter and larger. Copy free upon request.

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An Analysis of Gears

By DOUGLAS T. HARRIS

THE devices described in the first half of this article (published in March, 1939, issue of MODERN MACHINE SHOP) are intended primarily for checking individual elements of gear teeth, independent of other elements. Such devices are especially useful for checking original designs or when, at any given stage in the manufacture of the gear, a check on the individual elements is desired.

A close study of the action of gear teeth will reveal that there is always more than one tooth affecting the

operation of a mating pair of gears so that a careful check of the individual elements does not present a complete picture. An individual tooth element check does not indicate what effect a certain error in one tooth will have on another tooth.

An inspection of all errors in combination more nearly meets the demands of manufacturing requirements because it more closely approaches the actual conditions which prevail when the gears are in operation. These conditions are practically duplicated in an inspection machine designed to record the inaccuracies of the gear by means of a red line on a chart and thus known as the "Red Liner." The operation of the machine, which is illustrated in Fig. 20, is based on the principle that errors in gears affect their center distance relation when the gears are brought into intimate contact and rotated. One gear (generally a master of known accuracy) is held on the driving spindle, the latter being retained in a fulcrumed bracket as shown in Fig. 21. The gear to be tested is held on a fixed stud, or fixture, depending upon its design.

Errors in the gear being tested impart a movement to the fulcrumed bracket which, in turn, through a multiplying lever arrangement, operates a pen which is in contact with

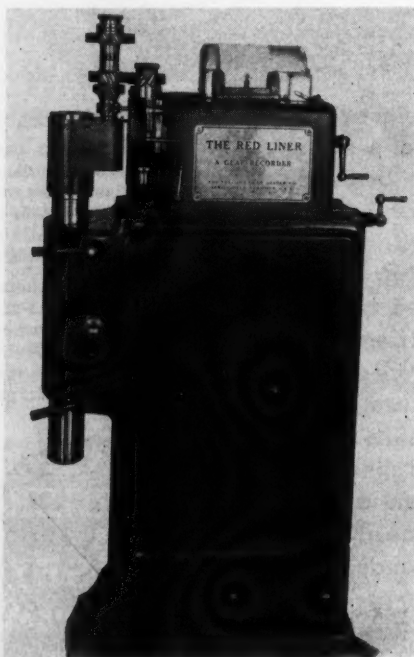


Fig. 20—Red Liner Recording Gear Inspection Machine.

Inspection Methods

GLAS T. H. follows Gear Shaper Company, Springfield, Vt.

a constantly moving paper chart. This device charts all errors in combination and makes a permanent record. It is possible to analyze the charts so produced and to determine the magnitude and location of various inaccuracies. The multiplication is 200 to 1, so that an error of 0.001 in. in the gear is represented as 0.200 in. on the chart.

Analyzing Gear Tooth Inaccuracies from Red Liner Charts

The inspection machine unflinchingly reproduces the inaccuracies in the work, and when the gear to be inspected is checked against a master of known accuracy, the result is a composite of all of the errors in the inspected gear. The errors, however, as the following charts will show, can be analyzed and their location and magnitude determined. These charts were made of the same spur gears which were projected in slides Nos. 1 to 8 inclusive.

Lack of Continuous Action

If the teeth of both gears are not of sufficient length, or have other defects which prevent continuous action, then the gears will fail to transmit uniform motion. Fig. 22 shows a chart of a gear, the teeth of which have been shortened to such an ex-

tent that continuous action is not obtained. Note the peculiar characteristics of the line. Action is interrupted as each tooth passes through mesh, causing a jagged peak and then a constant "building up" until action again ceases.

Uneven Tooth Spacing

Generally so-called errors in circular pitch produce a characteristic chart Fig. 23. This 32-tooth gear was cut with a cutter, each alternate tooth of which was purposely ground off from its true spacing position, resulting in the line shown. The complete chart shows sixteen jagged peaks, equal to one-half the number of teeth in the gear.

Variations in Pressure Angle

Fig. 24 shows a chart of a gear which varies in pressure angle from the master against which it was compared. Only a section of the chart is shown, but the complete chart shows 32 jagged peaks, equal

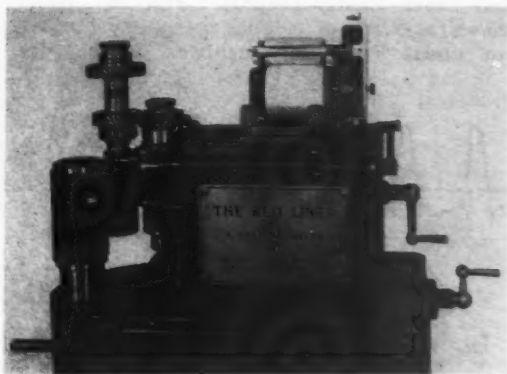
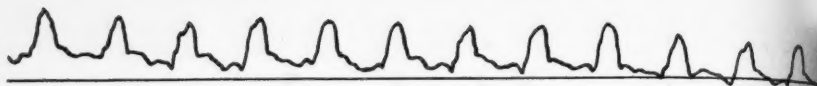


Fig. 21—The Master Gear is held on the driving spindle and the gear to be tested is held on a fixed stud.

Gear Inspe-



LACK OF CONTINUOUS ACTION

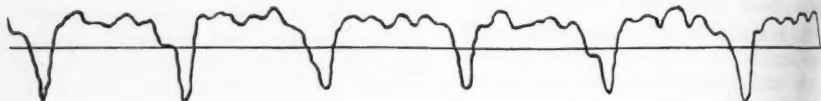
Fig. 22—Chart of a gear with shortened teeth.

to the number of teeth in the gear. This error was purposely exaggerated, making the "peaks" higher and sharper than would normally be the case with slight errors in pressure angle. Slight errors in pressure angle produce a chart somewhat similar to a sine curve, as shown in Fig. 25. A and B on this chart indicate the points when the tooth of the master gear and the gear being tested,

eccentricity causes the recorded line to depart from the datum line in one revolution of the gear being inspected, reaching the maximum deviation when half way around the gear.

Interference

There is no difficulty in locating fillet interference, as it causes a series of abrupt departures from a



VARIATIONS IN CIRCULAR PITCH

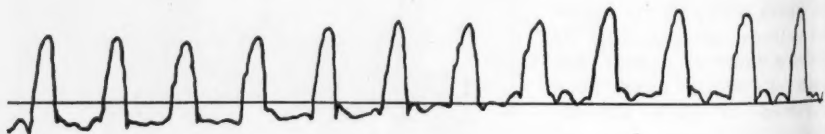
Fig. 23—This chart indicates errors in the circular pitch of the gear.

respectively, are centered on the line of centers.

Eccentricity

Lack of concentricity of the pitch circle is a common error, which the Red Liner clearly records. Fig. 26 shows a chart of a gear purposely cut about 0.004 in. eccentric. The

straight line as shown in Fig. 27. In this case the cut gear was purposely made too shallow so that contact took place in the fillet before the profiles could come into intimate contact, causing the gears to alternately come together and then spread apart.



VARIATIONS IN PRESSURE ANGLE

Fig. 24—This chart was made from a gear that varied in pressure angle from the master against which it was compared.

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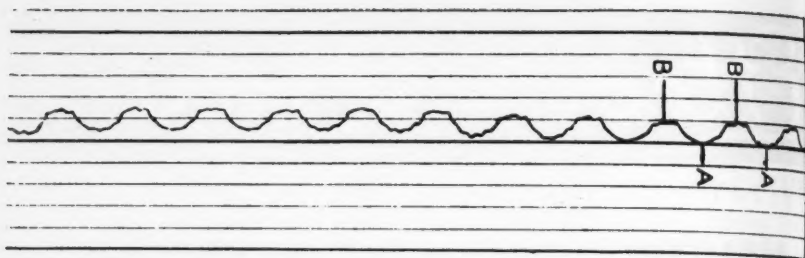


Fig. 25—Slight errors in pressure angle produce a graph similar to a sine curve.

ECCENTRICITY OF PITCH CIRCLE



Fig. 26—This chart indicates an eccentric pitch circle.



FILLET INTERFERENCE

Fig. 27—Fillet interference is indicated on this chart. The gear was cut shallow, so that contact took place in the fillet first.

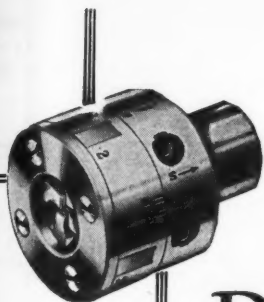
Charts of Cut, Hardened and Lapped Gears

In addition to recording tooth errors, the machine also presents an accurate picture of the contacting tooth surfaces. Fig. 28 shows a chart of a gear cut on the Gear Shaper without any particular pains being taken to obtain extreme accuracy—in fact, this would represent an average gear for this particular diameter and pitch. The accumulative errors do not exceed 0.001 in. The tooth surfaces are not extremely smooth and there are slight errors in circular

pitch. This, however, would prove to be a satisfactory gear if it could be used without being heat treated after cutting.

While great strides have been made in producing steels for making gears, it is still impossible to put a gear in the fire and have it come out in the same condition that it went in. Distortion, although in some cases slight, still takes place and as shown in Fig. 29, this particular gear did not improve any when placed in the fire.

Almost invariably gears swell dur-



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ing hardening. The two points on the teeth at which the greatest distortion takes place are in the fillet and at

gear-type lap, it was possible to bring the gear back to its original accuracy as shown in Fig. 30. Not



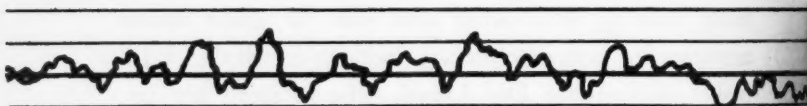
AFTER FINISH CUTTING

Fig. 28—Chart of an average spur gear for this particular diameter and pitch. The accumulative error does not exceed 0.001 in.

the top of the tooth. The fillet usually rises and the top of the tooth thickens on the end, which on the Red Liner is indicated as a combined interference and pressure angle variation error.

Before this particular gear was put

only has the accuracy of the gear been improved, but the tooth surfaces are considerably smoother, assuring this lapped gear would be quieter in operation than would be the case with the "green" or hardened gears.



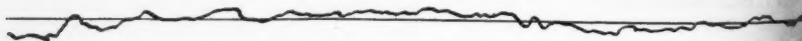
AFTER HEAT TREATMENT

Fig. 29—Chart made from gear indicated in Fig. 28 after hardening. Accumulative error is now 0.003 in.

into the fire, the accumulative error was 0.001 in. When it came out of the fire, this error had grown to 0.003 in., so that the tooth action was not as smooth as was the case when the gear was in the "green" condition.

By lapping this gear on a gear lapping machine, using an internal

In Fig. 31 the readings of this gear in three conditions, "green," hardened and lapped, are all placed on one chart for comparison. Note that eccentricity is practically the same amount in the "green" and lapped gear. There is, however, some improvement in smoothness of tooth surface, and a decided improvement



AFTER LAPPING

Fig. 30—Same gear after being lapped with an internal gear-type lap.

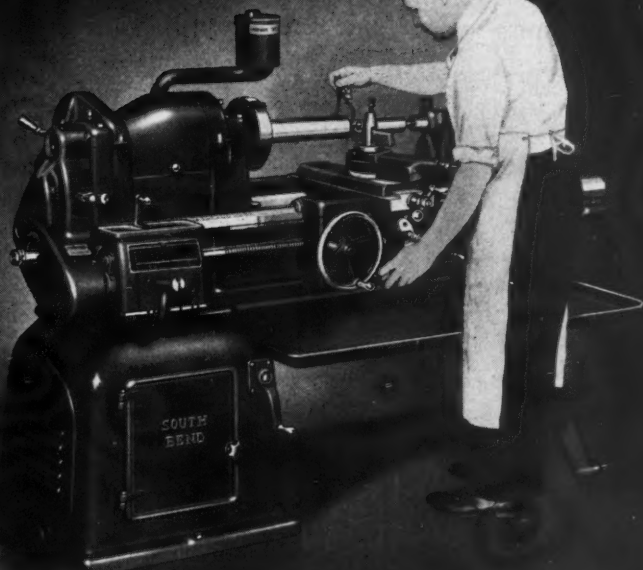
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April, 1916



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in all respects over the hardened gear.

The charts previously shown were

such is the case. Fig. 32 shows three Red Liner charts of a helical gear after cutting, hardening and lapping.

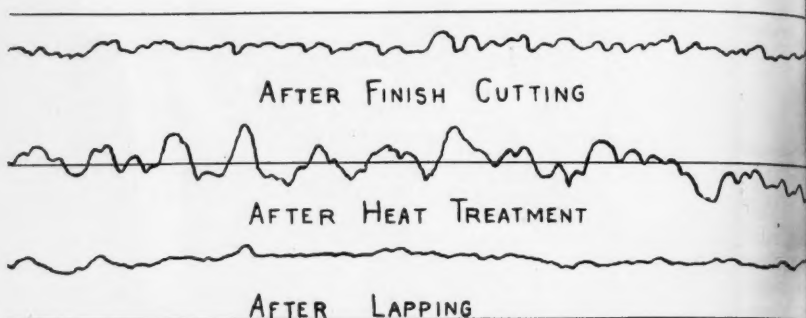


Fig. 31—Charts of the gear in "green," hardened, and lapped conditions.

all made on spur gears. Helical gears, if properly cut and mounted, show a decided improvement in action over spur gears. This is largely due to the fact that in helical gears contact is progressive across the face of the

Note that the lapped gear shows a considerable improvement over the hardened or the cut gear. In fact lapping has not only improved the tooth surface, but has reduced the errors to about half of what they

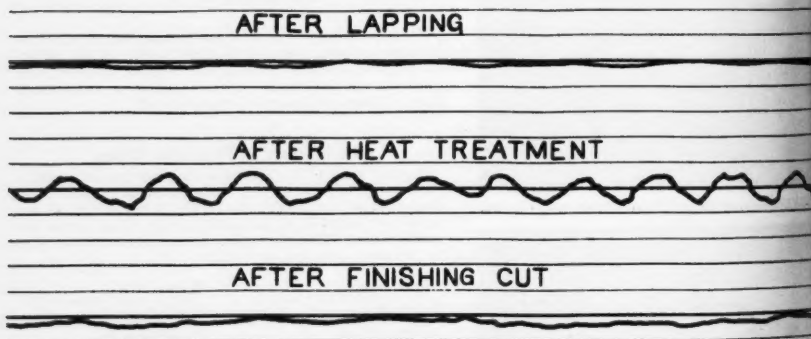


Fig. 32—Charts of a helical gear after cutting, after hardening, and after lapping.

tooth and is continuously at the pitch line in some one plane.

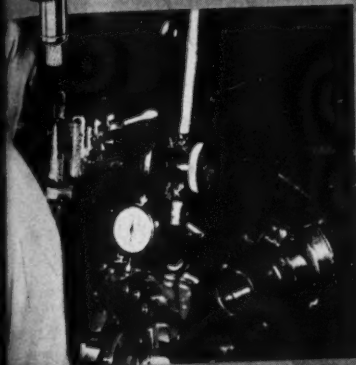
Obviously, helical gears should operate more smoothly and quietly than spur gears, and as a matter of fact,

were originally in the cut gear.

Up to this point we have dealt principally with what might be called the measurement of the physical dimensions of gear teeth. This in pre-



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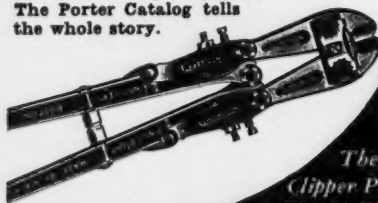
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ent-day practice is only the preliminary stage in accurate gear production and might be considered simply a means to an end. Much has been learned during the past few years about gear tooth action, and more particularly the relation of tooth action to quiet gear operation. There always has been and still is considerable mystery surrounding the subject of quiet gear tooth action. Those of us who have been engaged in this work have no doubt had cases where two sets of gears in all of the physical dimensions appeared to be exactly alike and yet one pair of gears operated quietly, whereas the other pair was noisy.

In an approach to this problem, we are, however, assured of one basic fact: noisy gears are the result of vibration. If there were no vibration there would be no noise. In some cases vibration is the result of unbalanced forces outside of the gear themselves, and the vibration is transmitted to the gears. In other cases, the gears themselves set up vibrations due to inaccuracies in tooth shape and other dimensions, as a result of improper mounting.

Our so-called physical dimensional inspection will give us, in tenths of a thousandth of an inch, the variation in tooth elements. It will not, however, give us a satisfactory answer to the question of tooth bearing, its location and area. Today, gear experts are paying much more attention to the tooth bearing than to any other factor. Tooth bearing is so closely allied, however, with several other factors, such as pressure, tooth shape, axial alignment, and so on, that in order to get anywhere we must necessarily have control over the various factors involved.

If we were dealing with but one of two surfaces, our problem would be much simpler. We are, however, dealing

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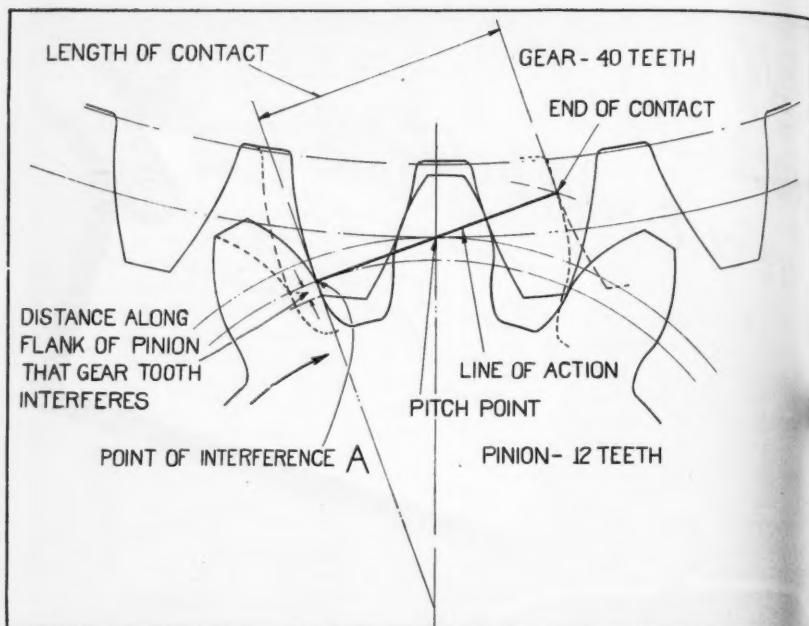


Fig. 33—Drawing of teeth of 10-pitch pinion with 12 teeth, 20-deg. angle, full length, in mesh with a gear having 40 teeth. In such a case, quiet tooth action presents a problem.

ing with a multiplicity of surfaces and these surfaces are in motion and contacting each other generally at high speed. If we consider gear teeth simply as levers of equal length with the "fulcrum point" at the pitch line, the number of levers being equal to the number of teeth on the two gears in mesh, we have a fairly accurate picture of the problem involved.

It is generally conceded that the arc of approach should be less than the arc of recession to obtain the best tooth action, and what has previously been said regarding interference evidently necessitates that the contact of the teeth in no case should take place outside the theoretical initial point of contact.

The drawing Fig. 33 shows a 10 pitch pinion of standard blank diameter, having 12 teeth, 20 deg. full length, in mesh with a gear of 40

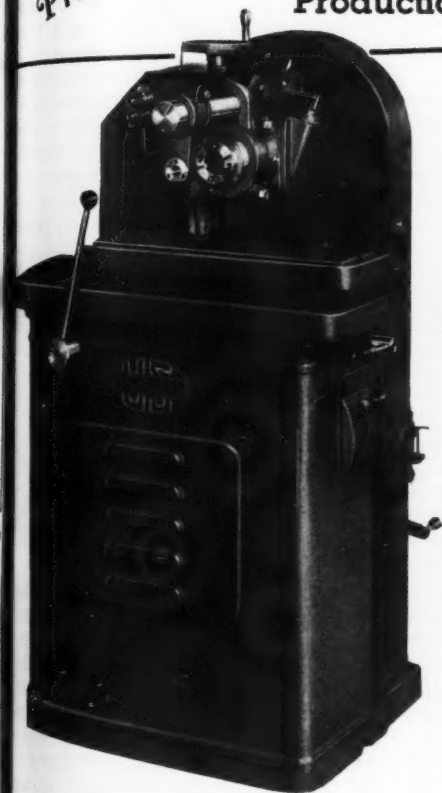
teeth. Contact takes place in advance of the interference point A on the line of action, and we are in for trouble. The question of quiet gear tooth action, therefore, is to some extent tied up with design, because there are certain definite factors which must in all cases be carefully considered. As design is more or less controlled by the application or use to which the gears are to be put, it is beyond the scope of this article. I simply bring this point up to show one of the pitfalls that should be avoided in laying out a set of gears to obtain the best possible action.

There are, in this particular case, five solutions to the problem:

1. The outside diameter of the gear can be reduced to the point where it does not interfere with the flank of the pinion tooth, retaining the same ratio and center distance.

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2. The ratio can be changed to use a pinion having a greater number of teeth; this will also affect the center distance.

3. The pinion can be cut oversize and the gear cut undersize a proportional amount, retaining the same ratio and center distance.

4. The pressure angle can be increased, retaining the same ratio and center distance.

5. The pinion can be enlarged by cutting say 12 teeth in a blank suited for 13 teeth. This will retain the same ratio but will increase the center distance.

It will be noted that the gear tooth "hooks" into the flank of the pinion tooth for a considerable distance inside the point of interference and thus will prevent proper tooth action. The position of the pinion and gear teeth where interference commences is indicated by the dotted outlines.

During the past five years the automobile industry, which is probably the largest producer of accurate gears in the country, has changed over almost entirely from the use of spur gears to helical gears for automobile transmission application. This change was not made because helical gears can be made cheaper; it was made with the object of obtaining quieter action.

If we investigate the action of a pair of spur gears, it is easy to see that quietness of action is almost impossible of attainment for the reason that just as soon as wear takes place, the tooth shape changes. This is due to the fact that the teeth wear at those points where they slip upon one another, and a spur gear, instead of "wearing in" to shape, wears out of shape. This is not true with a helical gear, especially when the latter is made so that the advance of the helix in the face width is equal to or greater than the circular pitch. With a helical gear designed along

these lines, the gears are continually in contact at the pitch line on some one plane, the result being that the teeth do not have an opportunity to wear out of shape in the same manner as a spur gear, and hence will remain quiet much longer.

Other problems are introduced in the application of helical gearing, that instead of dealing with a plain involute surface, we are dealing with a combined involute and warped surface, or involute helicoid. It is just as important to have the proper bearing on a helical gear as it is on a spur gear, for the reason that we can consider a helical gear simply as a multiplicity of thin or laminated spur gears, each lamination being set off in advance of the other in a helix corresponding to the helix of a helical gear.

In order to obtain the full advantage of the nature of a helical gear it is necessary that we get the tooth contact across the face width of the gear or else we do not obtain what is called "helical overlap."

The final test on gears for high speed operation is what is known as the shop as a speeder test. Making gears which are to operate together are held on rigid shafts located at the exact center distance at which the gears will be held in the assembled unit. One of these shafts is driven by a motor or by some other means, the power being so applied that vibration from the motor, or the drive, is not transmitted to the gears. Usually red lead is placed on one of these gears and the other either left plain or coated with Prussian Blue. They are then rotated together at high speed, both with and without braking pressure.

It is interesting to note in making one of these speed tests that a pair of gears when running light or without load may not have a tooth bearing that extends from the base circle

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to the tip of the tooth, and yet, when a brake is applied to the driven gear, the bearing area spreads out, running closer to the top of the tooth. Efforts have been made to measure the difference in the shape of the tooth between one giving a full bearing under

sufficient proportions so that it will not be deflected by the wheel, and then we traverse the wheel back and forth until it has stopped sparking. Without changing the position of the wheel as far as in-feed is concerned we remove the piece from the centers and lay it on the bench.

Then after it has cooled on the bench we again place it on the centers and start the wheel traversing. It will be noted that the wheel starts sparking again, but that the wheel shows eccentricity. So far, it has been impossible to measure the amount of eccentricity but we know that it exists. This indicates in a general way what we are against in connection with the testing of bearings on gear teeth. Just a slight change in the pressure involved spreads the bearing. Whether this is due to compression of the material or to tooth deflection is a debatable question, because even a slight load changes the height of the bearing on the tooth.

In Fig. 34 are illustrated sections of four helical gear teeth, indicating what is meant by various kinds of tooth bearings. At A is a "full" bearing extending from the base circle to the top of the tooth and across the entire face width. At B the bearing is lowered by a modification at the tip of the tooth. At C a tapered bearing is shown, which would result either from the shafts on which the gears were held being out of line or running two gears together of different leads. At D is shown a "crown bearing," which has recently come into prominence in connection with production of helical gears.

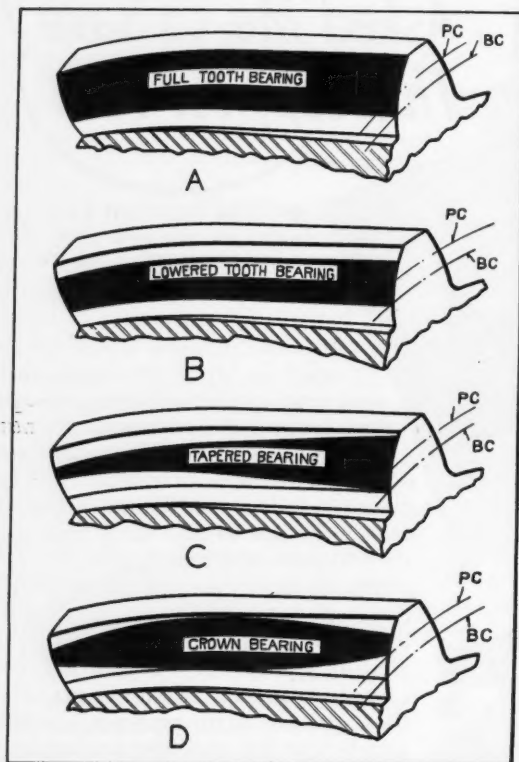


Fig. 34—Sections of four helical gear teeth showing different kinds of tooth bearings.

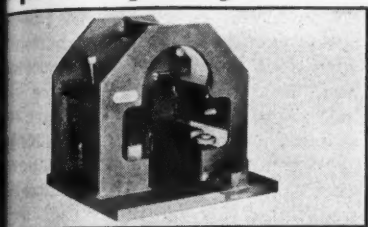
load and another with only a partial bearing when running light, but so far no means has been found by which this difference can definitely be determined.

As an illustration of what a bearing is, assume that we place a cylindrical bar between the centers of a grinding machine, this bar being of

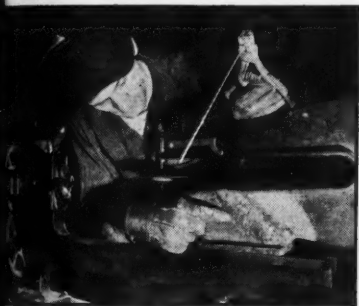
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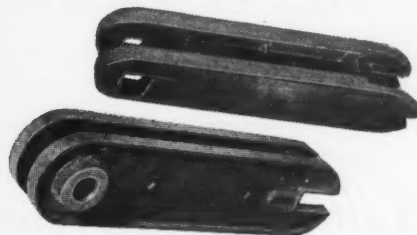
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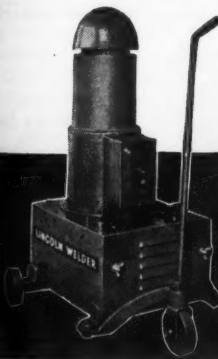
PAIR BROKEN PARTS—This cast iron arm of a circular shear was cracked and repaired with "Ferroweld" and a LINCOLN Welder. Ask for Bul. 401.



HARD-FACE TOOLS AND DIES—Four of these wheelbarrow stamping dies were reclaimed at a total saving of \$4800, with "Toolweld" and a LINCOLN Welder. Ask for Bul. 404.



PRODUCE WELDED PARTS—A shop changed this sprocket housing from the construction shown at the top to lighter, stronger welded steel and saved \$8.70 each with a LINCOLN Welder. Ask for Bul. 420.



NEW! Lincoln Machine Shop Welder with Self-Indicating "Job Selector" and Current Control assures maximum speed and quality for every job. Consult the nearest Lincoln office or mail the coupon.

THE LINCOLN ELECTRIC CO.
Dept. E-591, Cleveland, Ohio

☐ I am interested in welding.

_____. Send bulletin. ☐ Send Bul. 314-A.

Name _____ Position _____

Company _____

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It is contended by some that by confining the bearing to a full length bearing in the center of the gear and then letting it taper out gradually towards the ends of the teeth, as shown, that so-called "hooking" is avoided, which some claim results in noisy operation. This may be so, although it would appear that shaft misalignment is more responsible for hooking than the location of the tooth bearing. It has been demonstrated very conclusively in automotive practice that a gear tooth of the helical type, when produced so that it develops a full tooth bearing under load on the drive side and a lowered tooth bearing on the coast side, is the quietest possible gear.

Gear men have different reasons for wanting the tooth bearing located as shown at A and B on the drive and coasts sides of the teeth, respectively. It is generally believed that as the teeth pass through mesh under

load, the teeth deflect and interference takes place between the tip of the rear face of the contacting tooth and the forward face of the advancing or mating tooth. If the same amount of backlash, however, was used in helical gears as has been customary with spur gears, this might not happen, but as improvements are made in manufacturing methods, the amount of backlash permissible has been gradually reduced so that today about 0.002 to 0.003 in. backlash is a maximum for 8-pitch full-length tooth gears.

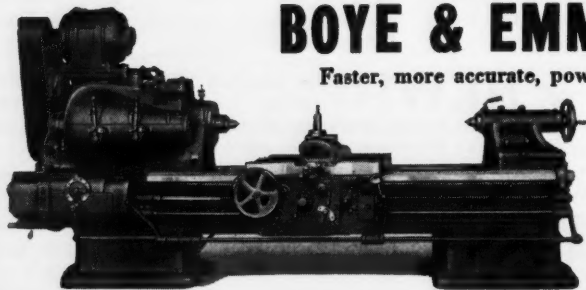
In some cases the permissible backlash is even less. This necessitates, of course, gears which are accurate as to spacing and with a minimum of eccentricity of the pitch circle. If it were possible to make gears absolutely accurate as far as spacing and concentricity were concerned, they could be operated together with practically no backlash.

Announcing the Newly Designed

Model "E"—24-inch

BOYE & EMMES LATHES

Faster, more accurate, powerful and convenient.



*Write for
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detailed
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CINCINNATI OHIO

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Holo-Krome gives you Appearance Value, too!

Holo-Krome FIBRO FORGED Screws, made by a New (patented) Method, result in COMPLETELY Cold Forged Screws giving Superior Performance. Now with the New Black Finish you have an appearance that equates Quality to any man's Product. Order Holo-Krome from your Distributor.

Compare the New Lustrous Black Finish—it's noticeably smart looking—the Finish accentuates the Quality Appearance of the Socket, Socket Walls, Threads and the smooth flat top of the head. FIBRO FORGED Screws are abreast of your designing standards with a Finish that "helps you sell."

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TRADE MARK

Socket Screws

THE HOLO-KROME SCREW CORP., Hartford, Conn., U.S.A.
British Representatives:
Geo. H. Alexander Mchys, Ltd., 82-84 Coleshill St., Birmingham





UNIVERSAL

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Because of their positive grip on either drill flutes or shanks and because of the easy drill adjustment for depth in multiple drill set-ups or screw machines, Universal chucks are ideal for all single purpose drilling. In addition they are the best tool holders for end mills.

UNIVERSAL
Engineering Company
Frankenmuth, Mich.

except for the question of lubrication. Backlash is introduced largely to take care of manufacturing and assembling errors.

Materials Handling Problems. A 4-page booklet entitled "How Handling Problems Have Been Solved with American Monorail" presents in pictorial form many solutions to industrial handling problems. The various types of tracks made by American Monorail Company, 13107 Athens Ave., Cleveland, Ohio, are described and illustrated. The major part of the booklet is devoted to photographs which show "American Monorail" overhead handling equipment installed in many different kinds of industrial plants.

Copy free upon request.

The "Compar" Combined Indicating Micrometer and Comparator, which is said to combine into one compact instrument both an improved micrometer and the equivalent of a set of solid tolerance gages covering a wide range of dimensions, is the subject of a six-page illustrated circular distributed by George Scherr Company, Inc., 130 Lafayette St., New York, N. Y.

The details of construction are discussed and information is given on the use of the "Compar" for regular measuring and also for quick checking of pieces in process or quantity inspection. Copy free upon request.

Parker Vises, product of The Charles Parker Co., Meriden, Conn., are the subject of Catalog No. 60 issued by this firm. The units presented include Parker's "Superior" and "Eclipse" Machinists' Vises, "Big Bear" Service Vises, "Victor" Swivel Jaw Machinists' Vises, Double Swivel Vises, Combination Pipe Vises, Small Anvil Vises, Filers' Vises and "Oriole" Vises. A listing of repair parts and prices is given. Copy free upon request.

Landis Chaser Grinders and Chaser Grinding Fixtures. Bulletin No. A-37-1 comprising eight pages of descriptive matter and illustrations covering Landis Chaser Grinders for grinding Landis Tangential Chasers and grinding attachments for these grinders, is now being distributed by Landis Machine Company, Inc., Waynesboro, Pa. Copy free upon request.

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April, 1939 April, 1939



You never see RED on the Tang—unless it's a SIMONDS FILE

And you never "see red" on the job... with the topnotch performance you always get from Red Tang Files. For Simonds makes only this one grade of file—the best that money can buy. Teeth are shaped like a metal saw... take off more metal with less elbow grease. And these teeth stay sharp longer, do not fill up or clog. For every type of filing work, there's a test-proved Red Tang File—always exactly uniform from one order to the next. USE IT... and get better work in shorter time, at lower cost per file.

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ASK YOUR

Made only by
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SIMONDS
Famous Family of
**METAL CUTTING
TOOLS**

Job Shop Expansion Due to Modern Methods

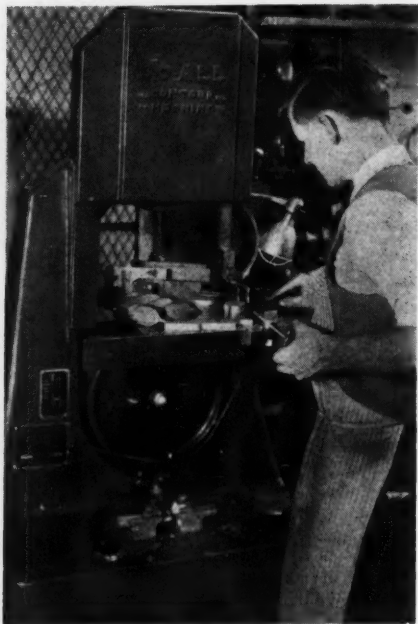
By L. A. PEIREZ
Sales Engineer

INVESTIGATION indicates that there are approximately 15,000 jobbing and tool shops in the United States today, and it is interesting to note that the histories of the origin and development of these shops are remarkably similar. In nearly every case the owners are skilled toolmakers with years of experience behind

them. As a rule, the shops are moderately financed, employ a small force of mechanics, and have only the most essential machines, which necessarily limits their possibilities.

In some cases the proprietors work along with their employees, overlooking the point that sales effort would be of more value to the business than their time in the shop. Every shop owner would like to see his business grow, but too often he is a better mechanic than business man and his business is limited by his narrow range of vision. However, occasionally such an owner finds the answer to the problem of what to do with his shop, and it is with such a shop that we deal in this article.

The Brooklyn Mica Die Company, Brooklyn, N. Y., was organized some three years ago by Kurt Promann and Henry Hohmann, both of whom are skilled toolmakers. At the beginning they were mainly interested in the fabrication of mica and film dies and small precision tools, and their equipment was selected especially for this work. However, the development of good will through good work slowly but steadily increased the business to a point where an increase in production facilities became necessary. And, like other small concerns of this kind, their capital limitations made it imperative that the additional equipment be selected with a view to obtaining the maximum pro-



Model J Doall Contour Sawing and Filing Machine in operation in the shop of the Brooklyn Mica Die Company, Brooklyn, N. Y.

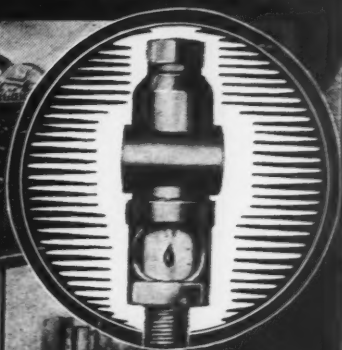
LUBRICATED FOR LIFE

The machine tool market asks for more pieces per hour. The machine tool asks for higher speed and more automatic control. The machine designer asks for ideas.

Let us help. Our engineers are ready to show you how Pulsolator can automatically lubricate your machines for life.

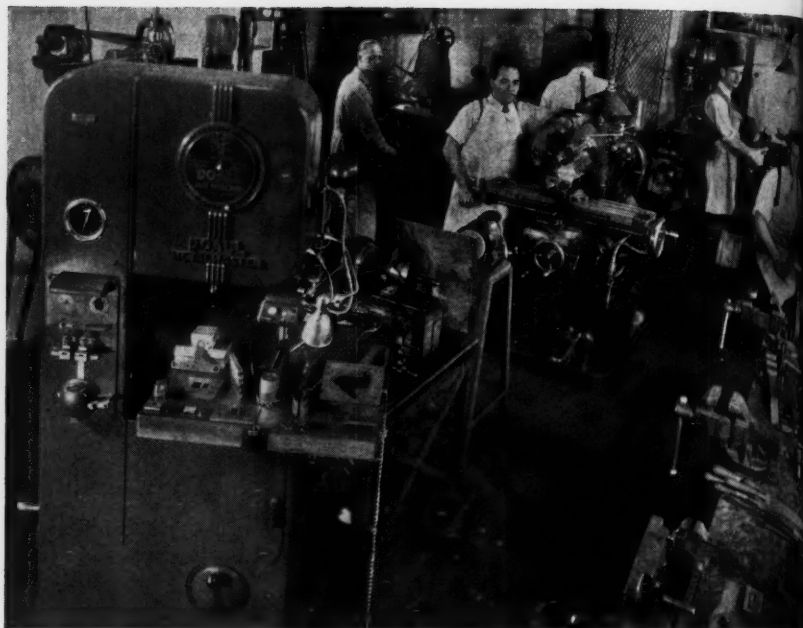
write for bulletin b-30

**Rivett
Lathe & Grinder Inc.**
Brighton, Boston, Mass



*Automatic
Oil
Lubrication*

BLANCHARD PULSOLATOR



Interior of Brooklyn Mica Die Company's shop.

duction efficiency with a minimum expenditure. The amount of money available was insufficient for the purchasing of all of the machine tools that seemed necessary, nor was there enough floor space to accommodate the extra machines.

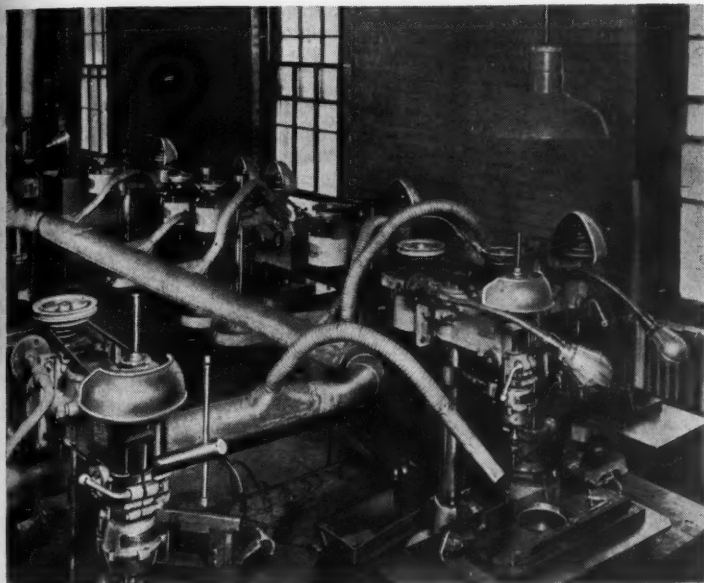
Among the dealers with whom they discussed their problems was the factory representative of Continental Machine Specialties, Inc., who suggested that a Doall Contour Sawing and Filing Machine be set up in their shop to see how much of their work it would handle. This was done, and it was found that with a modern contour sawing machine of this type, many operations could be performed that previously had been allotted to other types of machines. The demonstration proved conclusively that the installation of such a machine would make possible the handling of a much wider range of work than had

been possible previously.

It was found that contour machining would eliminate the need for many of the milling, shaping, boring, and drilling operations that had been necessary in the production of the parts, and that production on such parts could be increased with a corresponding decrease in costs. Lower prices and better deliveries attracted more business, including orders from competitive firms who were themselves unable to meet delivery and prices because of slower and more costly production methods. A steady business developed on the contour machining of dies, jigs, tools and other parts for competitors who found it cheaper to eliminate the more expensive operations in their own shops.

Within six months after the installation of the Model J Doall Contour Machine, the business of this shop had increased to a point where orders

How To Cut YOUR EQUIPMENT COSTS



Do you want to speed up production and reduce cost—without investing many thousands of dollars for new machinery? Here's a practical suggestion: There are many operations in your shop that can be handled more efficiently and economically by low-cost tools—by Delta drill presses that cost from \$28 to \$275, Grinders, from \$45 to \$54, Metal-Cutting Band Saws at \$79.00. Thousands of America's leading industrial concerns, including the largest, are using Delta low-cost tools to cut their equipment costs. Huge automotive factories, aviation and

motor plants, small part makers, plastic plants—every conceivable type of manufacturing plant is found on the list of Delta low-cost tool users. If these concerns can use low-cost tools to advantage—so can you!

DELTA MFG. CO. INDUSTRIAL
673 E. Vienna Ave. Milwaukee, Wis.

Send for Catalog

giving list of users, detailed descriptions of the complete Delta line and prices—and full information on how you can try any Delta tool in your shop without cost or obligation.



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Gentlemen: Send me latest Delta Catalog.

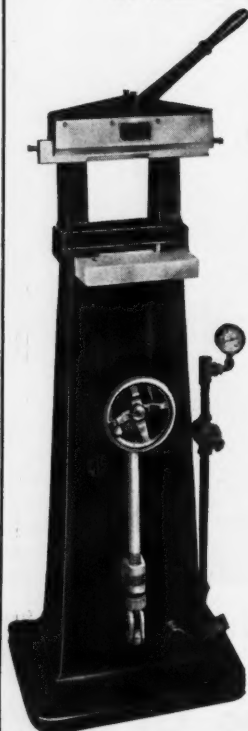
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ALWAYS
IDENTIFIED
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IN THIS MACHINE**



MARKING
BY ROLLING
IS FAST AND
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PRESERVES
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REQUIRES
ONLY FRACTION
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**QUICK
SET-UPS**

**MODEL 25
HI-DUTY
MARKING
MACHINE**

This machine operates from your plant air line, and is one of numerous models built to produce fast, neat marking on metal parts. Hi-Duty marking machines may be had for practically any marking operation, and we will be glad to make recommendations upon receipt of your inquiries. Send prints or samples of parts to be marked, showing lettering and location, also state required production.

GEO. T. SCHMIDT, Inc.
1806 BELLE PLAINE AVE.
CHICAGO, ILL.

were coming in for tools and dies for the silversmith industry, from cutlery and hardware manufacturers, camera parts, and so on. This additional work was more than the one machine could handle, so a Metalmaster was added to the equipment. This is a larger machine, with a greater speed range, an automatic butt welder, and the flexibility necessary to handle large work as well as the small precision parts found in the average tool and die shop.

An important feature of the Metalmaster is the Job Selector Dial, with which the correct cutting speed for any job can rapidly be determined. Instantaneous automatic butt welding of the saw blades through the starting hole in the workpiece makes possible the quick removal of stock. In some cases, by properly supporting the cutting tool when cutting on a segment or "slug" so that the material removed in the cutting is practically no more than the thickness of the saw, the slug can be used as a punch.

One of the illustrations shows the Model J Doall Contour Sawing and Filing Machine, and the other presents a view of the shop of the Brooklyn Mica Die Company. Mr. Hermann is standing at the milling machine, and Mr. Promnitz is sitting on the bench at the right side of the room.

Metal Stampings in Small Lots. Dayton Rogers Manufacturing Co., 210 South 13th Ave., Minneapolis, Minn., is now offering to the trade a small metal stamping service without prohibitive die costs. The Dayton Rogers Service is said to be advantageous in the development and manufacture of electrical devices, radio equipment, etc. machines, stamped automotive products, aircraft stampings, clocks and watches, precision and scientific instruments, and so on.

Details of the service are explained in a four-page folder issued by this firm. Copy free upon request.

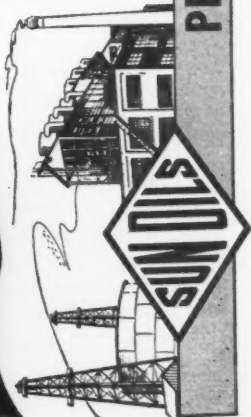
**Leaders CHOOSE SUNOCO
ACCURACY AND FINISH**
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FOR ACCURACY AND

A list of SUNOCO users reads like a "who's who" of the metal working industry. ♦ Take your cue from them. Whenever you've got a real tough job ahead, let SUNOCO help you... with fast, chatter-free, clean cutting. ♦ In your own shop—let a Precision way to profits.

SUN ENGINEER COMPANY, Philadelphia, Pa.

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Engineer show you the **SUNOCO**
SUN OIL COMPANY, Philadelphia, Pa.
SUNOCO
EMULSIFYING
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PETROLEUM PRODUCTS FOR ALL INDUSTRIES

Employee Education Methods at Farrel-Birmingham

Concluding Section --- Method of Selecting and Training Student Engineers for Executive Positions

By WALTER L. TANN

Planning and Control Engineer, Farrel-Birmingham Company, Inc.

WITH the increasing mechanization of all industries, and the consequent complexity of the heavy machinery which constitutes our line of products, it became apparent to our management a few years ago that the future key-men of our organization must be graduate engineers or the equivalent. As in most metal trades industries, the branch of engineering science that forms the basis of our work is mechanical engineering. While the industries we serve are for the most part in the field of chemical processes, such as the rubber, paper, sugar, and paint industries, or in the metallurgical field such as the steel, copper, brass, aluminum, and lead industries, we find that technical knowledge required to properly serve these and kindred fields can be interpreted in terms of mechanical processes and equipment.

The specific chemical or metallurgical knowledge that must form a part of the education and experience of the chemical engineers or metallurgists employed by these industries need not necessarily be a part

of the education and experience of our engineers, whether acting as sales representatives in the field, designing engineers in our engineering department, or as production executives in our plants. This statement should not be interpreted to mean that a knowledge of the processes involved in the manufacture of rubber products, for instance, is not necessary or desirable, because it is highly important. But the graduate chemical or chemical engineer would necessarily have had to confine himself, while taking his college training, to a few basic principles of mechanical design and methods of manufacture while majoring in the basic chemistry and chemical processes.

Therefore, we find that having mechanical engineering as a basis, a sufficient knowledge of the manufacturing processes of the industries which we serve can be obtained by means of motion pictures, lectures by our department heads who are familiar with the processes and problems of a particular industry, and later, as time passes and experience broadens, by actual contact with and observation of the particular industry itself.

Method of Selection

In order to provide technically trained men for future key-men for our organization, we select members of the graduating classes of prominent technical schools and colleges. Young men are chosen who have been successful in completing either the Mechanical Engineering or Engineering Administration Courses. Correspondence is constantly being carried on throughout each year with those members of the faculty of the engineering schools who are responsible for the placement of the current graduating class, and each spring a committee composed of our department heads visits various colleges and interviews the most likely candidates.

Close attention is paid to the scholastic standing of candidates, but this qualification is subordinated to the necessity for a pleasing personality and a record of being able to get along well with their fellows. "Brain Trusters" who can think only in terms of mathematics and applied

mechanics, and who neither understand their fellow-workers nor are understood by them, are poor material from which to build future key-men.

The young engineers who have been interviewed and who express interest are next invited to visit the offices and plants and are taken on a tour of inspection, not only of our plants, but of the town and environs. This inspection visit is usually made by only one prospective student engineer at a time, so that careful notes and comments may be made of his reactions, both expressed and implied.

Assignments

If the candidate is accepted, he begins work in the engineering department where he makes simple detail drawings and familiarizes himself with the system by which orders are entered, the routine of design, preparation of engineering order sheets, and in general becomes acquainted with the office personnel and with company practices. He spends six



Main Bay of Farrel-Birmingham Machine Shop, in Which the Student Engineers are Trained

months here and during that time, if he has lived up to the evaluation made by the management at the time he was taken on, has oriented himself with respect to the company, its methods and products, and his fellow-workers. The student engineer's next assignment is in the pattern shop, where he becomes familiar with the practical problems of pattern making and their relation to the drawings issued by the engineering department which he has just left. Some actual pattern work is done, but the main thought is for him to co-ordinate in his mind the relationship of the pattern shop and its work which, of course, involves pattern storage and records, with the plant activities as a whole.

He next goes to the foundry, where he does some actual work on the preparation of molds, the making of cores, and the actual production of castings. It is difficult, from the standpoint of training a student engineer, to definitely separate the pattern shop activities from those of the foundry, as they are so closely tied together in the every day operation of the plant. The principal value of the time spent in the foundry will be obtained from observing the commercial application of the principles and theories involved in the production of castings, regarding which the student engineer was schooled during his mechanical engineering training at college, and to evaluate this knowledge in terms of its relation to the manufacture of heavy machinery.

Six months is the length of the period devoted to pattern shop and foundry and during that time the student engineer learns not only of the problems involved in these departments and their commercial solutions, but also something of the shop personalities with whom he has worked.

The machine shop becomes the next training post, and here the young engineer becomes familiar with machine tools, economical set-ups, the various machining operations necessary and the parts that go into our varied line of products and also acts as a contact man between the shop and the engineering department. As in all shops, questions arise during the course of the day's work as to permissible variations from drawings for one reason or another, and here the student engineer acts to get the proper responsible persons together to discuss the matter. In no case does he act as judge as to what should be done, although in a simple case he may transmit the decision of the engineering department to the machine shop superintendent or to the foreman concerned.

In this manner he learns much of the practical side of machine shop management and, as in the case of his tour of duty in the pattern shop and foundry, sees the relationship between the engineers and the shop in a practical light.

For over one hundred years one of our important lines of products has been chilled iron and alloy rolls for the plastics, copper, metal, paint, and cereal industries, and a separate department is devoted to their manufacture. Here the student engineer is next placed for a period of six months so that he will learn of the processes and techniques involved in the making of these highly important elements of process machinery. The requirements are fairly simple compared to some present-day production problems, but extreme quality and accuracy are absolutely essential. While on the roll shop assignment, the young engineer has an opportunity to gain experience in the various phases of manufacture of these important parts of our complete machines, because not only do

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PNEUMATIC ARBOR PRESSES

Hannifin Pneumatic Arbor Presses for production press-assembly, broaching, piercing, keywaycutting, oil grooving, straightening, pressing, molding, and similar work.

Equipped with Hannifin improved air cylinders having simple outside adjustment of the piston packing. High efficiency operation is easily maintained throughout the entire life of the piston packing. Adjustment is quickly made without disturbing any other parts.

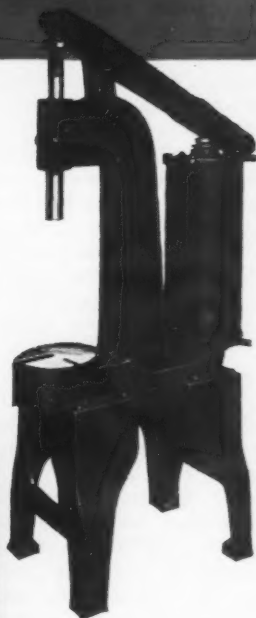
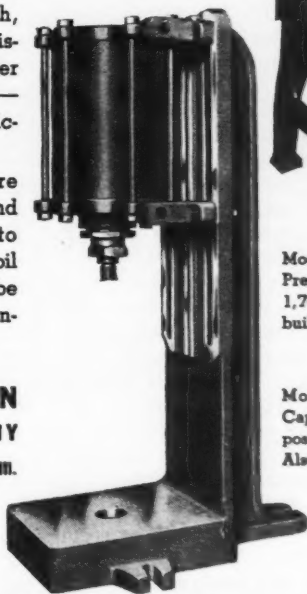
Cylinders are bored and honed, producing a smooth, round, straight bore. Perfect piston fit in an accurate cylinder bore means maximum power—no leakage, and minimum friction loss.

Hannifin Arbor Presses are built in a full range of types and sizes, capacities 600 lbs. to 50,000 lbs. Hannifin patented oil cylinder speed control can be furnished where a steady, controlled ram stroke is needed.

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Write for new
Bulletin 46-MM



Model B-2 steel frame Arbor Press. Built in capacities from 1,700 lbs. to 18,000 lbs. Also built for bench mounting.

Model AO-1 Arbor Press. Capacity 2,650 lbs. Cylinder position adjustable in frame. Also built in other capacities.

ENGINEERS • DESIGNERS • MANUFACTURERS • PNEUMATIC AND HYDRAULIC PRODUCTION TOOL EQUIPMENT

finished rolls enter into the machinery built for the process industries, but the roll shop production facilities are used on certain elements of other machines, such as final grinding of rams for hydraulic presses, grinding journals on shafts for various machines, and so on.

Three months are next spent by the student engineer in the metallurgical and welding departments where he gains experience in metallurgical control and the procedures and techniques involved in making weldments for machine bases, bedplates, all-welded gears, reduction gear housings for commercial, marine and naval applications, and also gear guards and other lightweight welded work. He becomes familiar with metallurgical and other test requirements of Lloyd's, American Bureau of Shipping, and United States Navy Inspection.

In addition, the student engineer is brought in contact with the practical applications of flame hardening and the technique of applying hard overlays of stellite and other materials. In short, he gets a working knowledge of the applications and also the limitations of the latest metallurgical practices and processes, and their uses in the manufacture of our line of heavy machinery.

While engaged on the welding assignment, he acts, as in the machine shop, as contact man with the engineering department and in addition, makes cutting sketches of various plates and shapes that enter into a weldment. Thus the work to which he is assigned is not only of actual productive value, but it serves to bring him in direct contact with welding operations and enables him to learn the practical aspects of this rapidly growing field.

The completion of his assignment in the metallurgical and welding departments brings to and end the stu-

dent engineer's course of training with respect to actual production processes. His next transfer is to the planning and control department for a period of three months where he works successively for a period of one each in the production, estimating, and methods divisions.

Although he has been made familiar by contact with the work of these divisions while assigned to various shops, he now does actual production control work by contact with the sales and engineering departments and with the various shops. He becomes familiar with the details of production scheduling and follow-up, not only in the shops, but of outside vendors through the purchasing department, and through work in the machine shop control office gains actual experience in getting successive operations performed in sequence on the various machine tools to which the parts have been routed.

He spends one month in the production division and from there goes to the estimating division, where he is given the opportunity to make small estimates and perform other duties that familiarize him with the procedures involved in preparing estimates for the sales department. After one month here, the student engineer is assigned to the methods division, where he works with methods engineers in establishing standard times and practices for set-up and machining, and in general makes himself useful compiling data and results of operation studies.

His last assignment is the cost department, where his work covers not only the usual field of compiling costs, but of computing payroll, social security and unemployment insurance, and fair labor standards and records. The issuance of controlling reports and the preparation of other data for the management are also

SAVE TIME!



**Accurately
Machined**

Sides, Ends, Base
Holds Work Square
Four Sizes

Without Swivel Base

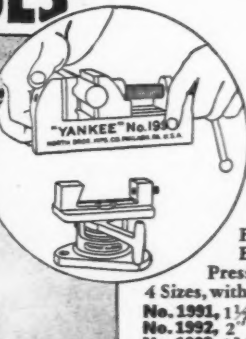
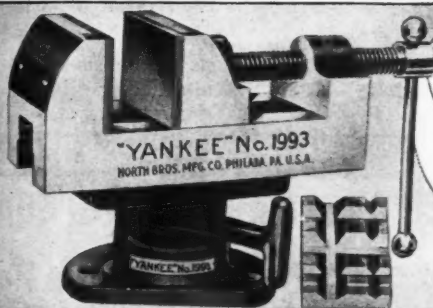
No. 991, 1½" jaw width.

No. 992, 2" jaw width.

No. 993, 2½" jaw width.

No. 994, 4" jaw width.

"YANKEE" VISES-



**Removable
with Work**

From Swivel

Base to Drill

Press Face Plate

4 Sizes, with Swivel Base

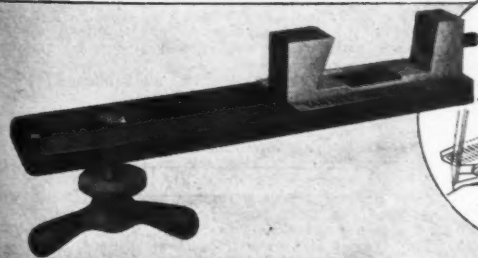
No. 1991, 1½" jaw width.

No. 1992, 2" jaw width.

No. 1993, 2½" jaw width.

No. 1994, 4" jaw width.

ATTACHABLE



**"YANKEE"
CLAMP**

Attaches Vise to Face
Plate. Quick - Easy

Two Sizes

No. 2992, 9½" long.

No. 2993, 10½" long.

CLAMPS

Order from your Supply House, For "Yankee" Vise Circular, write North Bros. Mfg. Co., Dept. MS, Philadelphia

done by this department. No attempt is made to do more than to show the student engineer the broader aspects of this department, but it gives him a clear insight into what reports and summaries are prepared and how they are prepared. One month is spent here, and at its completion the formal training of the student engineer is finished.

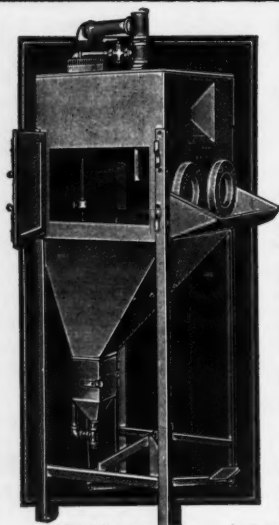
Benefits of Training

From the foregoing it will be observed that the student engineer, upon completion of the training, possesses a knowledge of all of our manufacturing operations that would not be possible to equal if he were given employment in some one department upon graduation and left to circumstance and his own initiative to gather the equivalent information. To the basic training received in his technical school he has added a broad knowledge of the applications of this essential theory to

the practical commercial work of the heavy machinery industry and with the specific techniques and practices in use in our shops.

The student engineer's aptitudes for a particular phase of our business have had plenty of time to develop, so at the end of his training period an effort is made to permanently place him on work for which he shows a definite fitness and liking. This, of course, must be governed by conditions prevailing at the time he completes his training, as it is not always possible to place him at once in the department of his choice or on the work for which he is pre-eminently fitted. However, his training history is recorded and he is put on the reserve list for ultimate placement on that work.

All student engineers are members of the evening study group (to be discussed later), and through the weekly meetings and discussions,



REMOVE HARDENING SCALE WITH LEIMAN BROS. (PATENTED) Continuous Feed SAND BLAST OUTFIT

It furnishes a modern, cleanly way of cleaning moulding sand from patterns and castings. Letters and designs stenciled. Will replace the scratch brush for mat finishing and similar effects on all classes of goods—it will replace the use of disagreeable acids for this work.

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The most inexperienced person can operate it without instructions—the work cannot be spoiled.

Metal goods of every kind and description should be sand blasted to increase plating durability.

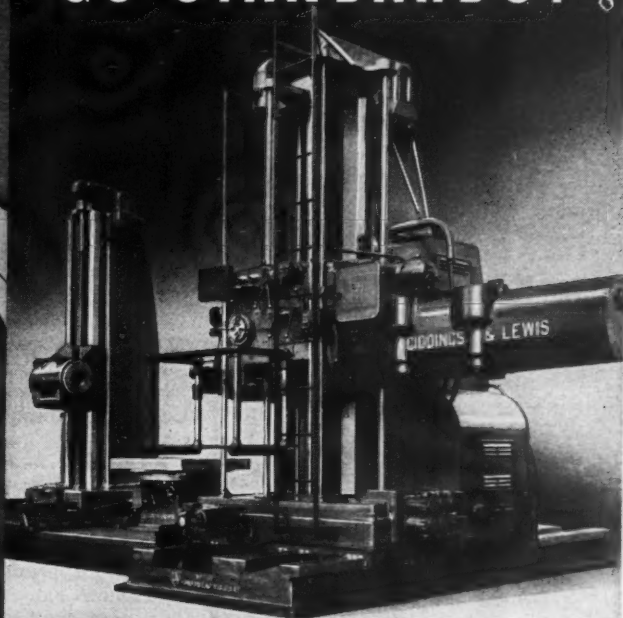
The sand blasting process makes a surface to which electro plate will adhere more securely and much more rapidly and so sand blasting saves time in plating, and improves your finish. This also applies to articles to be painted, sprayed, enameled or otherwise treated. Mat finishes of various degrees are quickly secured.

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they are brought into close contact with company practices and personnel. Most of them have had college courses in the same field and on the same subjects covered by the studies of the group, but the discussion of the application of the principles to our own organization shortens their period of orientation with and assimilation into our organization as a whole. Three members of a previous training group which operated under a more limited assignment program than our present course are found today in the following positions: head of production division; methods engineer, and sales engineer. We have every reason to feel that with the breadth of training now given that we will find equivalent material among those now working under this present training plan.

Training in Principles of Work Simplification

With a constant supply of new mechanics coming along as graduates of our apprentice training course, with new blood entering the organization as student engineers, and with the educational activities of the evening study group, it might well be said that we are making a good effort to insure ourselves against the future man-power requirements of the business by providing a reservoir of trained personnel to fill almost any conceivable demand. The apprentices are schooled and experienced in the techniques and craftsmanship of their trades; key-men and junior executives, through the study and discussion group, gain a well-rounded knowledge of the principles and application of industrial management; student engineers become familiar with the work of every department and add to their basic engineering training the advantages gained by their attendance and participation in the discussions of the study group.

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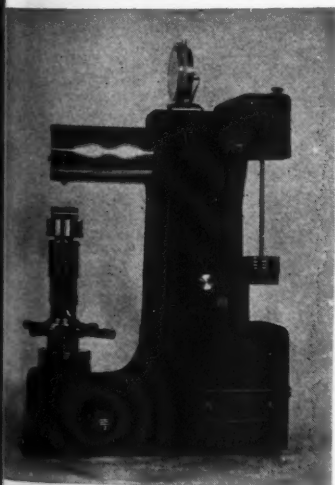
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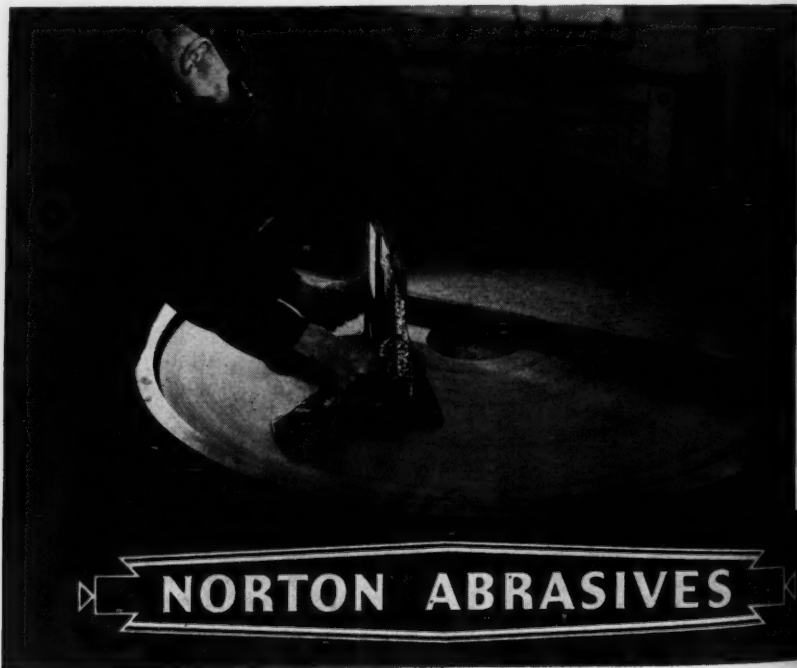
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W-699



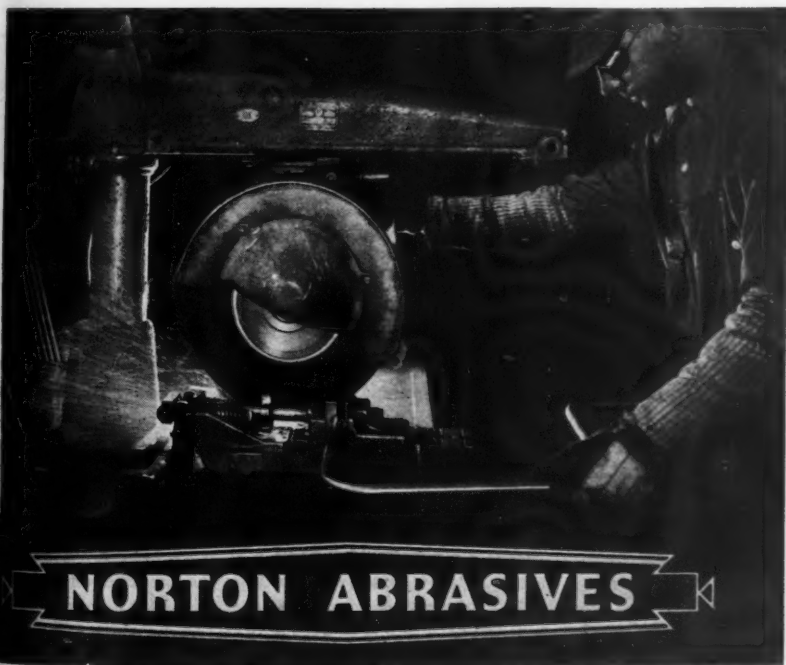
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CUTTING-OFF and slotting are now real production jobs and the Norton Resinoid Cut-off Wheel is a real production tool. In many plants where careful records are kept this wheel shows the lowest cost per cut. It also reduces the amount of stock lost in machining and finishes the cut so well that in many cases subsequent machining is not necessary. For many wet cutting operations and for jobs where a minimum of burr is desired there are also Norton rubber bonded cut-off wheels. Norton engineers are available to study your cut-off jobs and recommend the correct wheels.

W-700



Thus far we have concerned ourselves with HOW to do the work required—now let us describe a program aimed at a study of the ONE BEST WAY to do the work.

Training Program Begun

About a year ago a program was instituted under the leadership of Mr. Allan H. Mogensen to find the "one best way" through a study of the principles of work simplification. Three groups of foremen and junior executives met under Mr. Mogensen's leadership during working hours and at such time as was most desirable for the personnel involved, and in the evening, all senior executives from the president down met at a dinner meeting. One day every other week was devoted to this program, which began in September and ended in June.

Realizing at the start that the very nature of our product and method of

production; i.e., making heavy machinery on the job-order basis, precluded the adoption of some of the methods and mechanisms used profitably in mass-production plants, we aimed our program at the "one best way" to do our work. All attending the meetings were instructed in the six basic questions that must be answered before the "one best way" can be found. These six questions are:

- 1—WHY should the work be done?
- 2—WHAT is to be done?
- 3—HOW is the work to be done?
- 4—WHO is to do the work?
- 5—WHERE is the work to be done?
- 6—WHEN is the work to be done?

To answer these questions required an analysis of the operation being studied, and finding the correct answers to all means "a better product at a lower cost—and at the right time."



Double-Type Pullmore



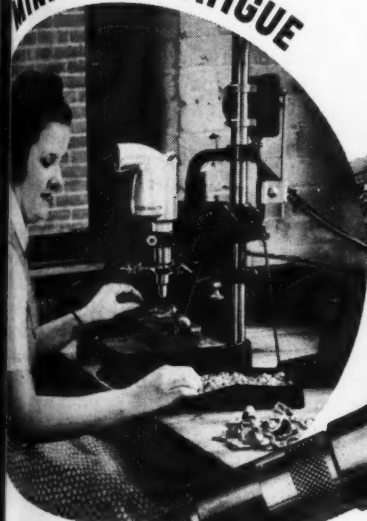
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Two Double Pullmore Clutches, in oil, are used in the Pratt & Whitney Jig Borer; one drives and breaks spindle, one controls direct drive on back gears. Pratt & Whitney specification is ample evidence of Pullmore reliability, high quality, operating excellence. Pullmore Clutches also meet design and performance requirements in cranes, industrial trucks, packaging machines and many other high grade mechanical products, fit readily into modern machine designs, are simple, rugged, compact, easily installed and adjusted. Available for oil or dry operation, in capacities from 1 h.p. to 75 h.p. at 500 r.p.m. Use Pullmore Clutches for efficient, low cost power transmission and control. Investigate. Write today for Pullmore Blue Book.

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**Dyno-Mite
Screw Driver.**

10" long, weight
3 pounds.

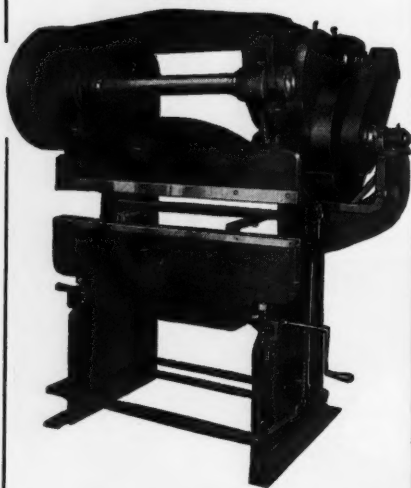
Sure one-hand
control.



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by the average shop.**

Here's a profitable, economical brake ideally adapted for rapidly forming metal sections such as in stoves, refrigerators, soda fountains, steel cabinets, metal furniture, steel boxes, and a great variety of sheet metal specialties. Its variable speed drive operates from 17 to 50 strokes per minute. The No. 253 CHICAGO STEEL PRESS is accurate, compact, and ruggedly constructed of highest quality materials.

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How the "One Best Way" Is Found

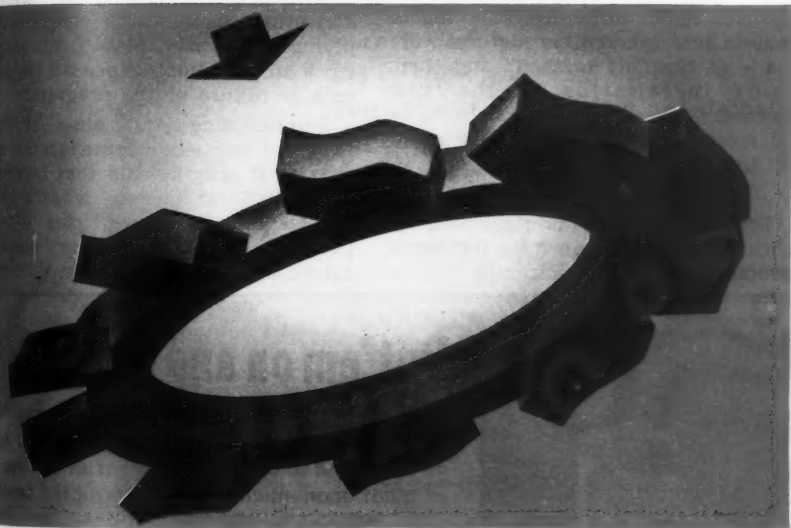
In investigating and analyzing the movements and operations involved in manufacturing an element of a machine, there is nothing better than the well-known "process chart" which shows progressively the movements, storages, operations and inspections for a particular piece of work from the time it is received as a rough casting, forging or weldment until it leaves the department being studied. The distance traveled between the various machines and storage spaces can be shown in terms of feet and in general a well-nigh perfect picture can be obtained of the time, distances and handlings involved.

All attending the meetings were instructed in the meaning of the symbols and method of preparing process charts. All participating in the program were required to make up and submit a process chart covering some every-day duty such as "sharpening," "building a furnace fire," and so on, showing "present method" and improved "proposed method," indicating the number of feet traveled, number of operations, and so on, that might be saved by adoption of the proposed improved method.

From these elementary beginnings, the program progressed to definite assignments on actual process charts, showing the present operations and travel of actual parts in process in our shops, and paralleling the chart, showing the present method, was shown a chart involving a new and improved proposed method. Plans were under way at this time for important building additions and re-vamping of the layout of our foundry and application of these principles of work simplification was of great help in obtaining a practical work and space-saving layout.

One particularly worth-while assignment was a study of a certain

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group of machine tools over which passed a good percentage of relatively small parts entering into several widely different lines of products. Process charts used in conjunction with layouts showing existing machine tool locations demonstrated clearly the advantages that would be gained by shifting the "center of gravity" of these many operations, by moving a few tools that were located away from this natural center of flow of the work.

To make permanent records of the changes found to be desirable and to sustain interest, motion pictures were made of the "old method" and then, upon installation, of the "new method." These films were shown at all meetings and added to the proof of accomplishment.

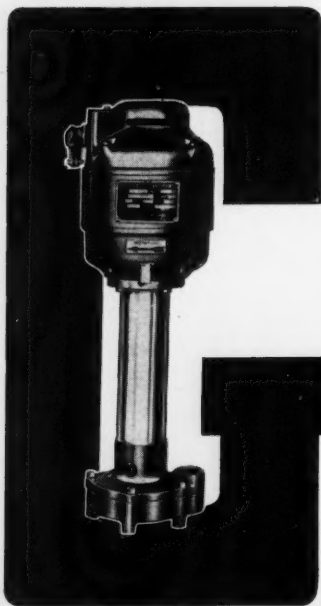
Results

Probably most readers are familiar with the usual principles of work simplification, so no attempt will be

made here to discuss the training program in any further detail than already given. Suffice to say that at the completion of the program, sufficient proof of its value was available to warrant the assignment of a methods engineer to continue the work in the shops.

The senior executive group, meeting in the evening of the day devoted to the program, was productive of much worth-while discussion and kept all executives informed of the program's progress among the foremen and others upon whose efforts in applying these principles to the actual work in the shops depended the success or failure of the program.

Summarizing the aims of this phase of our employee education activities, it may be said that here was mass-application of modern job-order production principles to our plant and products. Every man in attendance was schooled in these im-



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If your machines are equipped with Ruthman "GUSHER" Coolant Pumps, you can be sure of a dependable flow of coolant at all times—of quiet economical and uninterrupted service.

"GUSHER" Pumps can be opened up to a gusher or throttled to the merest trickle without building up pressure or harming the pump in any way.

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One of these tappers will give you better work, practically eliminate tap breakage and will cut your tapping costs down to rock bottom. We are here to lick your tapping troubles. Let us show you what we can do for you on your own tapping or external threading jobs.

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PROCUNIER high speed precision tapping heads are designed to fit your every need. The most complete line available. Ball bearings; double-cone long life friction clutch; balanced reversing mechanism and the new TRU-GRIP tap holder. Tap rotates in the tapping "in" direction when idling.

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It will show you the
way to greater
tapping satisfaction.



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portant factors and we have only begun to feel the benefits. Our present work simplification program, which is under the immediate supervision of one of the attendants at the program conducted by Mr. Mogensen, includes foremen's meetings on such topics as "The Security of Our Jobs," "Handling Workers Through Their Motives," and like subjects on industrial economics and psychology, and we will also include special courses for shop men in the principles of work simplification. Attendance at such courses will, of course, be entirely voluntary on the part of the worker.

Conclusions

We feel that a product cannot be much better than the men who build it and that our service to our customers will be no better than the men who have a part in rendering that service. Therefore it seems to us

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IN ONE
CUT

KENNAMETAL-tipped tools produced an accurate surface on this 18" diameter stainless steel casting in one cut. This is typical of the successful performances which are gaining KENNAMETAL repeat orders and a reputation for reliability and efficiency. Harder than the hardest tool steel, yet unusually strong, it will machine steel heat-treated up to 500 Brinell, as well as softer metals. Write today for catalogue showing how to brace your own tools with KENNAMETAL blanks.



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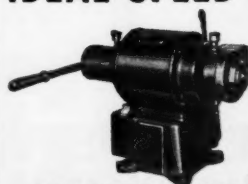
that along with offering products design and construction suited to today's requirements, using machine tools capable of producing work costs tuned to today's markets, and incorporating materials equal or superior to present day specifications we must make available to all employees educational facilities in various forms which will enable them to increase and maintain their skills and knowledge of their jobs, on a plane comparable to the machinery they build. By such a program, all will profit.

Over fifteen years ago the Federal Board For Vocational Education summed up the necessities for a program such as ours with the following statement:

"Society, as a whole, has to pay the bill for inefficiency. Half-trained or poorly trained workers in any field increase production costs, which in turn are passed on to the consumer. Clearly the public, laborers as well as others, have an interest in securing an adequate supply of well-trained workers for every line of necessary work."

Granting the economic truths in the above statement, it is evident that a long-range employee-training program is a long step forward toward the full recognition of the "social responsibilities of industry," an implication that we read and hear of daily at every hand.

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CUT DIE COSTS THREE WAYS WITH STRENES METAL

Save 30% to 50% with this Widely Used Forming and Drawing Die Alloy

The next time you tool up, don't fail to specify that at least one die shall be made of cast-to-shape Strenes metal. This close-grained, long run die alloy will set new economy and performance records for you just as it has done for scores of others...for one-half the automotive firms for example.

Lower Initial Die Cost: The raw Strenes stock is considerably less costly than conventional die materials. Furthermore, by casting this chrome-nickel-molybdenum

alloy to shape, machining time is greatly reduced.

Greater Resistance To Wear: Strenes metal is famous for its ability to resist wear. Several Strenes dies have produced over 1,000,000 stampings out of medium heavy materials.

Less Maintenance Expense: Strenes metal is close-grained (see illustration above) and takes a high polish. In addition, it has a high graphitic surface lubrication which enables blanks to easily slip over working surfaces without galling or "picking up."

Check into the stamping operations in your own plant. If you have a use for Strenes metal, write for full details.

THE ADVANCE FOUNDRY CO., Dayton, Ohio

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STRENES METAL

FOR DRAWING AND FORMING DIES



IDEAS FROM READERS

Time-Saving Adapter for Second-Operation Work

By J. B. COFFEY

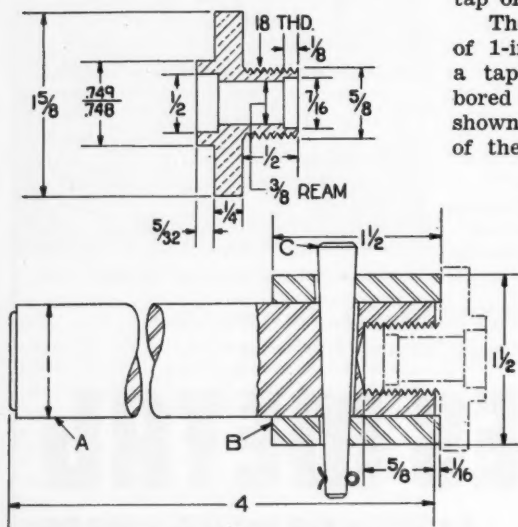
THE detail in the upper part of the drawing presents the dimensions of a brass workpiece of the type that usually requires two operations for complete finishing. In the first operation the piece is turned to $1\frac{5}{8}$ in. diameter and an 18-P. thread is cut on the small end. A $\frac{3}{8}$ -in. hole is also drilled and reamed through the

axis of the piece and the end is counterbored $\frac{1}{8}$ in. diameter by $\frac{1}{8}$ in. deep.

In the second operation, the opposite end of the piece is turned to 0.748—0.749 in. diameter and counterbored $\frac{1}{2}$ in. diameter by $\frac{5}{32}$ in. deep. To make an adapter for the second operation into which the piece can be threaded is a simple matter, but a wrench is usually required to loosen the piece so that it can be removed when finished. The adapter illustrated here is so designed that the piece can be loosened by a light tap of a hammer.

The adapter consists of a piece of 1-in. stock A, the sleeve B, and a taper pin, C. This section A is bored and threaded at one end, as shown, to receive the threaded end of the workpiece. The sleeve B and the section A are drilled and reamed as shown for the taper pin C, the sleeve being drilled at a point which will allow one end of the sleeve to project over the end of the piece A after the several parts have been assembled together.

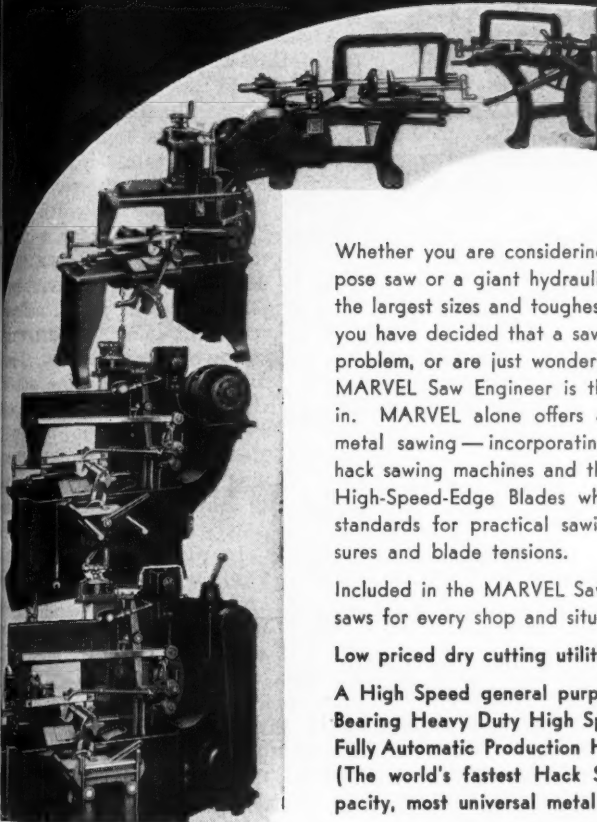
In use, the workpiece is threaded into the end of the adapter until it presses tightly against the end of the sleeve. As it is threaded further, the sleeve bears against the taper pin C, and still further tightening locks the



Design of Time-Saving Adapter for Second-Operation Work

MARVEL

Ask the MARVEL Sawing Engineer



Whether you are considering a small general purpose saw or a giant hydraulic capable of handling the largest sizes and toughest alloy steels—whether you have decided that a saw is the answer to your problem, or are just wondering if it might be, the MARVEL Saw Engineer is the logical man to call in. MARVEL alone offers a complete System of metal sawing—incorporating a complete line of hack sawing machines and the composite MARVEL High-Speed-Edge Blades which have changed all standards for practical sawing speeds, feed pressures and blade tensions.

Included in the MARVEL Sawing Machine Line are saws for every shop and situation, including:

Low priced dry cutting utility shop saws.

A High Speed general purpose shop saw. All-Ball Bearing Heavy Duty High Speed Sawing Machines. Fully Automatic Production Hack Sawing Machines. (The world's fastest Hack Saw.) The largest capacity, most universal metal cutting Band Saw.

A "giant" Hydraulic Hack Saw—the world's largest hack saw that handles the toughest steels in sizes to 18" x 18" with ease.

If you use metals in bars or billet form, a MARVEL Sawing Engineer will call at your request, analyze your sawing or cutting-off problems, and make recommendations covering sawing methods and equipment to fit your range of work and production requirements. This service is given without cost or obligation.

**ARMSTRONG-BLUM
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"The Hack Saw People"
5745 Bloomingdale Avenue,
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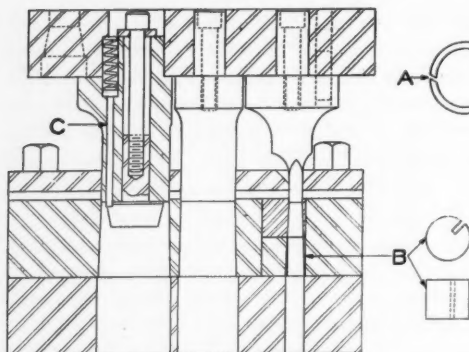
Eastern Sales Office:
199 Lafayette St., New York

workpiece in position. After the second operation has been performed, the taper pin is loosened by tapping it on the small end, removing pressure from the workpiece so that it can easily be unscrewed by hand.

"Kinks" for Die Designers

By WM. C. BETZ

IN the production of the blued spring steel rings illustrated as A in the drawing, we found that the job was being retarded due to the fact that,



Drawing Illustrating Use of Shedder Pins and Inserts in Die Design

in the slotting operation, the ends of the pieces were cocking. This was undoubtedly due to lack of tension of the work in the die bore, and prevented the feeding of the stock for the following blanks. A number of similar dies had been made for blanking smaller sizes of rings from thinner stock and had given no trouble, but the ring shown is over an inch in diameter and the stock thickness is 0.010 inch.

To eliminate the trouble, we drilled three $\frac{1}{8}$ -in. holes vertically through the punch and counterbored them from the back or upper ends as shown. We then made pins to fit the holes, as shown at C, the upper end

of each pin having a head and the lower end projecting below the end of the punch so as to act as a "shedder." Spiral springs above the pins served to push them down so that they would force the rings down in the die after blanking.

Another novel feature of the die is the method of piercing the slot in the first stage of the operation. Instead of drilling and filing out the solid die, or making a button in two pieces as is often done, we made a disc of the design shown at B and sawed a slot of the required width in the disc. The slot did not extend to the center of the piece, however, thus it would have the tendency to collapse when the piece was driven into the main die section. Clearance was filed on the sides of the slot and the end was sawed to provide proper clearance, but no clearance was provided in the die proper, as it was deemed unnecessary.

In making a disc of this kind we leave the length about $\frac{1}{8}$ in. more than is actually required in order to afford stock for chucking.

We chuck the piece in a cylindrical grinder to grind the O. D. to a drive fit in the main die piece, then the excess stock on the end is ground off and the disc is pressed into the die.

Tools For Slotting Small Meter Rims

By CHAS. H. WILLEY

THE drawing illustrates a set of tools that were designed for the piercing of two separate slots in the piece A, which is a replacement rim for the Model B Ford dash ammeter. The two dies, B and C, are mounted on the die block D at an angle of 90°



Barnes Field Men are trouble shooters. They know what hack saw blades and band saws are intended to do. To help you out of a hole, they'll hop onto the job as quickly as a fireman on a five-alarm blaze.

So if you have a metal cutting problem, write Barnes at Detroit or call up your regular distributor. Either can make the connection between your problem and the right answer.

W. D. BARNES CO. INC.

DETROIT MICHIGAN



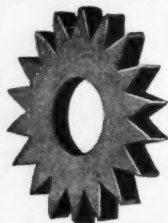
To get real performance from your grinding wheels, they need a good dressing regularly.



The best way to be sure the job is done right, is to use New Improved Vincent - Huntington dressers with bushings that can't turn and wear out the bearing holes in the handle.

These new type Huntington dressers, equipped with cutters heat treated by the "Vincent Process" to the proper degree of hardness and toughness, is your assurance that the dressing will

be well done. Call your nearest Mill Supplies distributor. Insist on the dressers with the aluminum finish.



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VINCENT STEEL PROCESS CO.

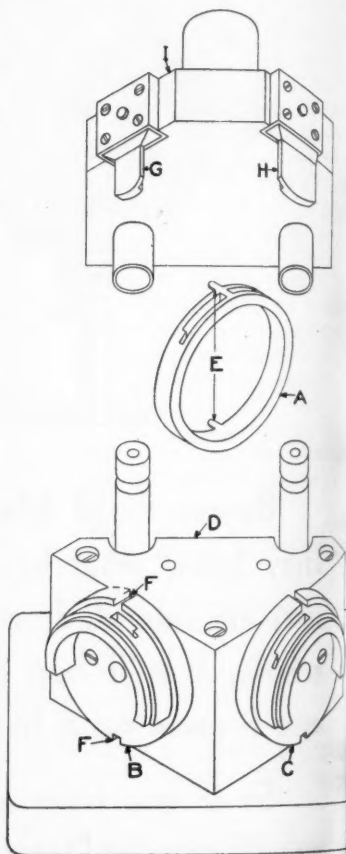
2434 BELLEVUE AVENUE

DETROIT

MICHIGAN

"If it's a Huntington dresser or cutter Vincent makes it."

deg. from each other, and the punch G and H are mounted on the upper die member I in the same manner. The workpiece A, which has been formed in a previous operation, is



Drawing Presenting Design of Dies for Punching Slots in Meter Rim

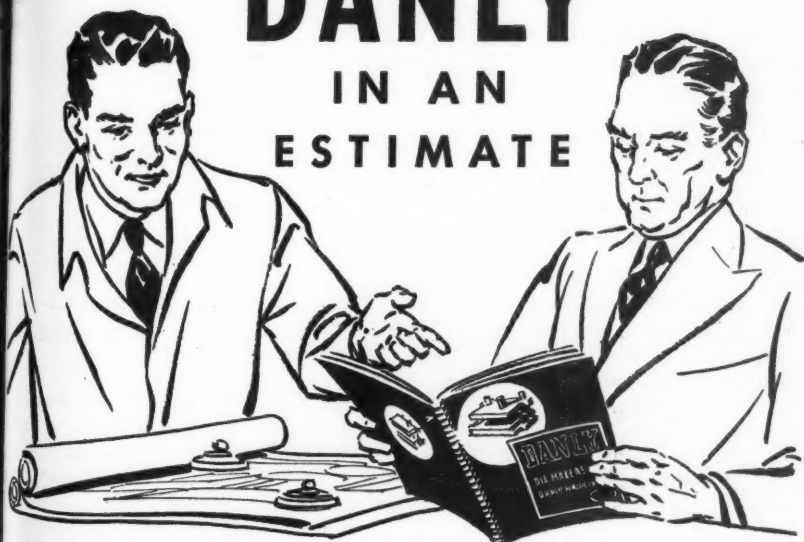
two tabs E on its rim, the tabs being provided to attach the meter rim to the back of the meter.

To slot, the workpiece A is positioned on the die B, the tabs E being located in the slots F. When the punch is operated, the punch G pierces

THERE'S A GREAT COMMON
INTEREST IN THAT WORD

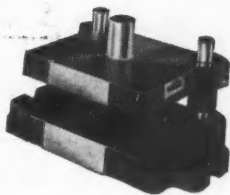
"DANLY"

IN AN ESTIMATE



When Danly Die Sets are specified for the mounting of dies, it means:

- that the die maker is protected from lost man hours or added machining not included in his estimate.
- that the die user is protected from set-up and production delays, frequent regrinds and high stamping costs.



DIE BUYERS—Specify Danly Die Sets for Your Dies

DIE MAKERS—Include Danly Die Sets in Your Estimates

It will be good business for you both

DANLY MACHINE SPECIALTIES, Inc., 2112 So. 52nd Ave., Chicago, Ill.

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DANLY DIE SETS and DIE MAKERS' SUPPLIES

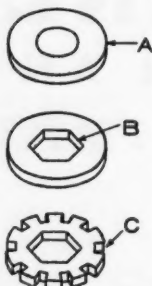
Their Dependable Quality Means Lower Cost Stampings

slot. The same workpiece is then located on the die C, where the second slot is pierced by the punch H. Two pieces are, of course, pierced in a single operation, producing a completed piece at each operation of the press.

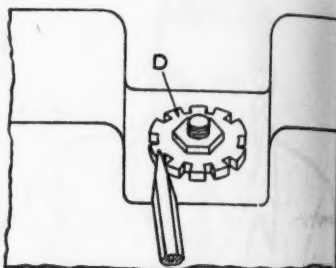
Accessory for Loosening an Inaccessible Nut

By A. H. WAYCHOFF

IT sometimes becomes necessary to loosen or tighten a nut which, because it was applied before the complete unit was assembled or because it had been threaded on with a special wrench which is now unavailable, is impossible to turn with an ordinary wrench. Illustrated



Steel Washer Cut and Notched for Use in Loosening or Tightening and Inaccessible Nut



**GRAY TURRET HEAD
METAL CUTTER OR NIBBLER**

Cuts all metals any shape—
30 gauge up to 1".

GRAY, Originator of
First Practical Metal
Cutter or Nibbler.
GRAY Cutters Still
Lead.

GRAY MACHINE CO.
Dept. A., P. O. Box 596,
Philadelphia, Pa.

WALES HOLE-PUNCHING and NOTCHING DIES

For PUNCHING round or shaped holes any place in all sizes of flat sheets • For NOTCHING four corners and V's in between • For NOTCHING DEVELOPED CORNERS for round cornered casings • For COMBINING all kinds of notches and punches in one operation.

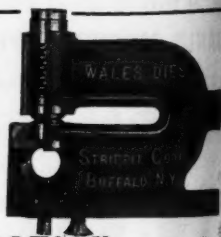
NOTHING ATTACHED TO THE RAM OF THE PRESS

Write for Bulletin A

THE STRIPPIT CORPORATION

1559 NIAGARA STREET

BUFFALO, N. Y.



herewith is a special "washer" which is designed to aid in performing this task under such difficulties.

A steel washer, A, is filed or ma-

chined out to fit the nut as shown at B, then a series of notches are cut in the edge of the washer as shown at C. To use, the washer is slipped into place over the nut, then the point of a dull chisel is inserted into one of the notches as shown at D. By tapping the chisel, the nut can usually be tightened or loosened as desired.

Haskins Ground - From - Solid Rotary Files, made from a special grade of tool steel and ground from the solid in one piece after hardening, are described and illustrated in a folder now being issued by R. G. Haskins Company, 619 S. California Ave., Chicago, Ill. The folder also presents hand cut files, rasps, and mill cut files. Copy free upon request.

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N. Y.

April, 1939 April, 1939

*Open the door
to a complete*
**STEEL
STOCK ROOM**



You can enjoy all the benefits of having a complete steel bar stock next door—without investment or expense for space, labor and insurance—by getting in touch with your nearby Union Drawn Distributor. He carries quality cold finished steels in all popular sizes and shapes. And because he never is more than a few hours' hauling distance away, the bars you want will be in your plant shortly after you call him.

Let your Union Drawn Distributor provide your next-door stock room. His 'phone number is your pass-word that opens the door to dependable steel service. If you wish, he can also assist you in selecting the right steel for the purpose.

UNION COLD FINISHED STEELS



Over the Editor's Desk

UNDOUBTEDLY the greatest single problem affecting the "life, liberty, and pursuit of happiness" of the American people today is the unemployment problem. It isn't that the needs or desires of the nation are filled; thousands of people are still without automobiles, radios, mechanical refrigerators, comfortable homes, and many other necessities and conveniences denied to them by lack of income through unemployment or fear of the loss of employment.

People cannot buy without money, and money comes to the majority as compensation for services rendered. When the opportunity for service fades, business lags, business failures increase, people without work are forced to accept charity, and people who are fortunate enough to have income from jobs or otherwise are forced to keep their more unfortunate neighbors. The ills that can be charged against stagnant business are of infinite number and variety.

If all the idle people in this country could be put to work, they would buy enough products of all kinds to keep our factories busy. If the factories could find markets for their products, they could hire all who want work. There may be other factors that bear on the matter, but that is the situation in a nut-shell. The problem is: How can we get the machinery of production and distribution operating at normal speed, and what is necessary to keep it running, once it is under way?

It is to the credit of the American Society of Tool Engineers that they have taken upon themselves the task of determining the effect of the development of the machine on unemployment and the standard of living. A preliminary report, delivered at the preview dinner at the recent convention and exhibition in Detroit, indicated that the fact-finding committee charged with this task is well qualified to find the answer, and it is equally certain that the answer to this question will also be the answer to other and equally important ones.

A surgeon, an engineer, and a politician were arguing as to which of their professions was the oldest. Said the surgeon, "My profession has existed since the first man. The Bible tells us that the Creator took one of Adam's ribs and used it in the creation of Eve, thus performing the first surgical operation."

The engineer replied, "My profession is older than man. In fact, it is as old as creation, because the Bible states that the Lord brought order out of chaos, and that is an engineering task."

The surgeon was ready to agree that the engineer's profession was older, but the politician said, "Wait. Who do you think created the chaos?"

In spite of the fact that unemployment is the country's most important problem, the politicians do not seem to have made much headway with it. When the A.S.T.E. Fact-Finding Committee has completed its work on the relation of the machine to unemployment, we hope the committee will continue with the job of finding out what can be done to get idle machines in motion and reduce the unemployment. The engineers are as capable of finding the answer as any other body, and if they can discover the solution they will have rendered a service which will redound to their everlasting glory.

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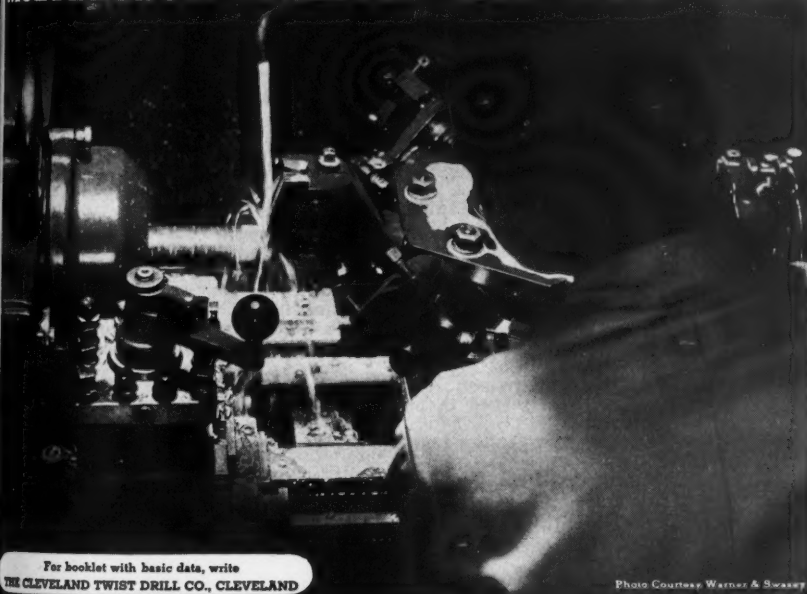
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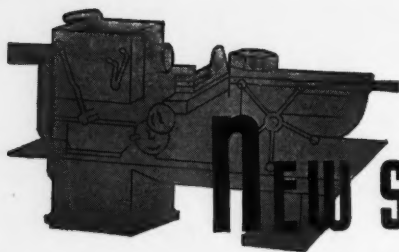
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8857



NEW SHOP EQUIPMENT

Gisholt High Production Turret Lathes

Many new refinements to improve the performance and ease of operation, increase machine life, and further extend its field of usefulness have been incorporated in the Gisholt 1L, 2L and 3L high Production Turret Lathes built by Gisholt Machine Company, 1219 E. Washington Ave., Madison, Wis. Bar capacities range from $2\frac{1}{4}$ to $4\frac{1}{2}$ -in. diameter and from 36 to 48 in. long. The machines have a swing over the ways ranging from 19 to 26 in. and employ chucks ranging from 12 to 21-in. diameter. The machines are intended for both high production of similar pieces and small lot jobbing of various types of work, and are equally well adapted to both bar work and chucking work.

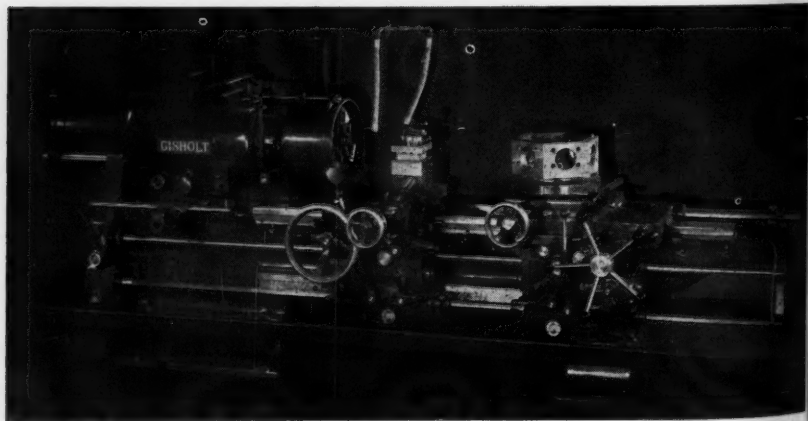
The machines have the new solid hardened steel ways, made of high carbon alloy steel and hardened clear through. The ways are ground in per-

fect alignment with the spindle.

The strongly braced headstock is cast integral with the bed casting, which provides an exceptionally rigid construction. Twelve spindle speeds are available, the normal range of which for the 1L and 2L machines is from 20 to 480 r.p.m. and for the 3L machine, from 12 to 333 r.p.m. All speeds are arranged in a geometrical progression.

The spindle is mounted on precision type tapered roller bearings and all shafts in the headstock, as well as the aprons, are mounted on anti-friction bearings. The gears are of high carbon chrome molybdenum steel hardened and the tooth contours are ground. The high speed gears are of the helical type. A double multiple disc clutch is used for starting and reversing the spindle and a powerful multiple disc brake automatically stops the spindle when the machine is shifted into neutral.

Sixteen reversible power feeds in two ranges of eight each are provided to



Gisholt Model 2L Production Turret Lathe

both longitudinal and cross feeds of the cross slide or the cross-feeding hexagon turret. The longitudinal feeds range from 0.004 to 0.136 in. and the cross feeds range from 0.002 to 0.068 in. on the 1L machine and 0.002 to 0.084 in. on the 2L and 3L machines. The feeds are engaged and disengaged by quick releasing type levers or the feed trips may be set for automatically disengaging the feed at the completion of a cut.

A safety shear pin in the feed train on each carriage protects the feed gears against overload due to tool failure or accident and a safety friction affords similar protection to the rapid traverses. All apron gears are made from alloy steel and heat treated.

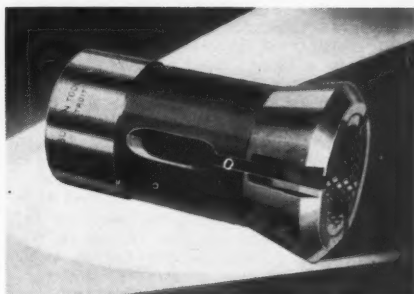
Multiple V-belt motor drive is standard on all three machines and the motor is mounted on the top of the headstock. Standard motor recommendations for the 1L machine are up to 10 h.p. For the 2L and 3L machines, the motor recommendations are up to 15 h.p. For high speed operation, 15 h.p. motors are recommended for the 1L and 20 h.p. motors for the 2L and 3L machines. Rapid traverses are provided for the longitudinal travel of both carriages and also for the in-and-out travel for the cross slide on the side carriage. The rapid traverse levers are provided with colored knobs for the operator's convenience.

All three machines are supplied with either fixed center hexagon turret or cross-feeding hexagon turret. The fixed center hexagon turret is recommended for work occurring in sufficient quantities to employ multiple tooling, such as multiple turning heads and piloted boring bars. The cross-feeding turret is particularly efficient on small lot work where the production is too small to absorb the set-up time for multiple tooling. The cross-feeding turret may also be locked on center and used with piloted turning heads and piloted boring bars with the same effectiveness as a fixed center hexagon turret machine. The cross-feeding hexagon turret employs simple tools such as single point boring bars, single point tool holders, and so forth. Holes are bored by adjusting the turret off center the desired amount.

The headstock is automatically lubricated by a splash system, which carries oil to all gears and bearings, and the taper roller spindle bearings are oiled by a continuous flow of filtered oil from a catch reservoir in the headstock. The aprons are automatically lubricated by



Spotlighted For Hot-Rolled Stock



DIAMOND-GRIP Compensating Master Collet with diamond- serrated Pads

◆ ◆ Pads of the Sutton Compensating Master Collet are self-adjusting in the master so that they automatically rock to a perfect bearing on the stock. This advantage permits this collet to be used on hot-rolled stock that is within mill tolerance... No pins or screws are used to hold the pads in the master. Pads are interchangeable so that one master and different sets of pads equip a machine.

◆ ◆ Complete listings of all styles of DIAMOND-GRIP Collets for all screw machines in Sutton Catalog 12. Send for a copy.

Sutton Tool Company

2842 W. Grand Blvd., Detroit, Mich.
Represented in Canada by
HI-SPEED TOOLS, Ltd., Galt, Ont.



Accessories for Screw Machines

an oil pump which directs a steady stream of oil over all gears and bearings and the hardened steel bed ways are lubricated under the carriages by a force feed pump which is engaged each time the rapid traverse is employed. The aprons are closed and all gears, shafts and bearings run in oil baths. The gear train which drives the feed shafts is enclosed and also runs in oil.

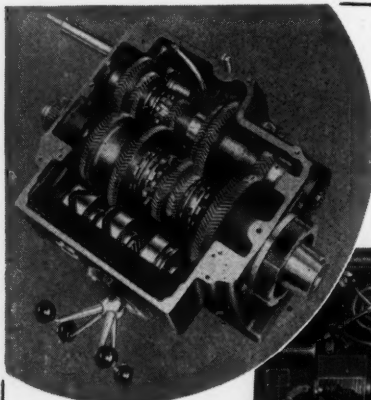
The available attachments include a built-in taper attachment for the cross slide, provided with a standard guide plate for cutting tapers up to 1½ in. per foot and 12 in. maximum length, or special guide plates may be furnished for tapers up to 3 in. per foot and 6 in. maximum length. Tapers may be cut at any point within the travel of the cross slide. The hexagon turret taper attachment is also available, which is of the heavy bed type design and permits cutting tapers or taper bores up to 8 in. taper per foot and 12 in. maximum length. Power-operated bar feeds are available for all three machines. A single lever here actuates the collet chuck and the bar feed. A movement of this lever forward engages a quick-acting friction clutch, which advances the bar stock by power to a turret stop. A movement of the lever backward dis-

engages the clutch, closes the collet and grips the bar ready for machining. Thread chasing attachments are available for both the side carriage and for the hexagon turret carriage.

Compound rests with power angular feed are available for all three machines. If desired, a compound rest with hand angular feed is also available for all three machines. In addition to this, the Gisholt Machine Company has available an extensive line of standard tools and tool holders for these machines, as well as three-jaw screw chucks and four-jaw independent chucks.

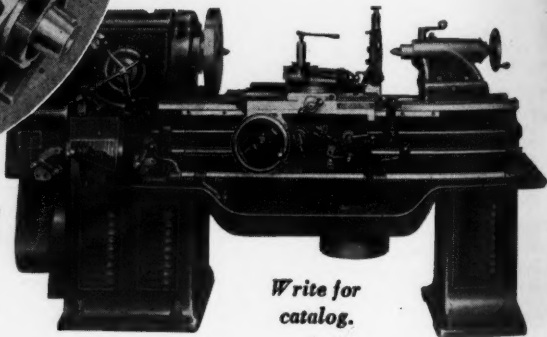
Brown & Sharpe No. 2 Vertical Milling Machine

A No. 2 Vertical Milling Machine of the light type with power fast travel has been added to the line of milling machines built by Brown & Sharpe Machine Co., Providence, R. I. The machine has a capacity of 28 in. longitudinal feed automatic, and 10 in. transverse feed automatic. Vertical feed of knee is 10 in., also automatic. Actual feed of spindle is 3 in. Maximum distance from



All-Herringbone Transmission Only in Sidney Lathes

An all-herringbone transmission, composed of 12 continuous-tooth gears, completely eliminates all gear tooth or tool marks from the work. Controlled by Monotrol (1 dial) or Tritol (3 levers). Sizes 14" to 24".

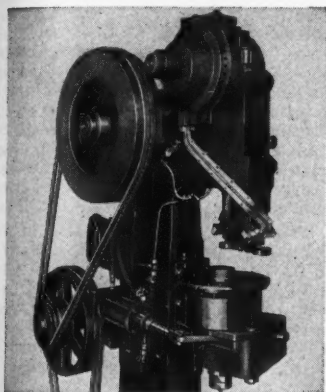


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MACHINE TOOL CO.**
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Sidney, Ohio

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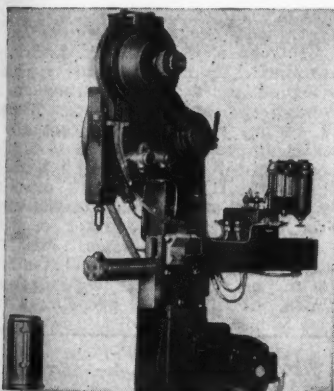
ready serves these industries



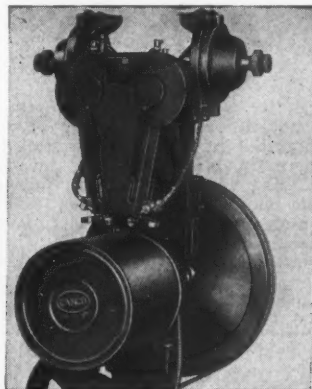
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This is the standard "BR" Bench Type Rivitor tooling for setting $\frac{1}{4}$ " diameter x $\frac{3}{4}$ " long duralumin rivets in airplane sections.



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This Rivitor sets two rivets at the same time to attach handle brackets to bodies of percolators.

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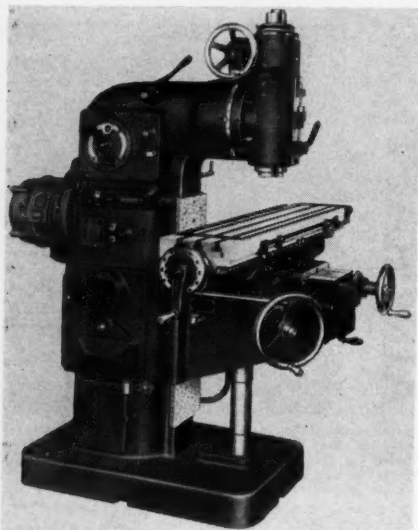
620 N. Mechanic Street, Jackson, Michigan

Agents in principal cities in United States. European

Representative: Gaston E. Marbaix, Ltd., London.

spindle to top of table with spindle vertical, 18 in.; from center of spindle with spindle horizontal, 24 $\frac{3}{4}$ in. Throat distance, center of spindle to face of column, 12 inches.

The machine is driven by a 3 h.p.



Brown & Sharpe No. 2 Vertical Milling Machine

constant speed flange type motor mounted at the rear, providing an all-gear drive. The motor is started by moving the machine starting lever and the same lever operates a brake for quick stopping. No friction clutch is used. Fast traverse in all directions is obtained by an independent $\frac{3}{4}$ h.p. motor mounted on the right side of the knee.

Sixteen changes of speed are available in practically geometrical progression, 55 to 1,800 r.p.m. in either direction. Changes are made in two series by sliding gears controlled by a single rotating lever, a high and low series selective lever, and a back gear lever. A direct reading dial indicates the speed engaged. All gears are of heat-treated alloy steel, ground on the tooth form, with integral keys. Anti-friction bearings are used largely throughout the drive from motor to cutter. The spindle is of special alloy steel with standardized end, hardened and ground. The hole through is 21/32-in. diameter with No. 40 milling machine standard taper hole at the end. The spindle is mounted on anti-friction bearings.

The spindle head swivels in a vertical plane and can be set at any angle to 90 deg. either side of zero. A locking plunger provides for exact vertical alignment of the spindle. A 3-in. axial movement is available in all positions of the spindle head, movement being obtained by use of a handwheel which may be used on either side of the head.

The table, including oil pans and channels, is 50 $\frac{1}{2}$ x 10 in. Working surface, 45 x 10 in., with three T-slots $\frac{1}{2}$ in. wide. Feeds are all gear driven through alloy steel sliding gears mounted in anti-friction bearings. An overload release is provided, and drive is automatically re-engaged when the overload is removed. Feeds are independent of spindle speeds. There are 16 changes of feed in practically geometrical progression from $\frac{1}{2}$ to 18 $\frac{1}{2}$ in. per minute, changes being made by a single rotating lever with direct reading dial at the left side of the machine. Fast travel is provided for longitudinal, transverse, and vertical table movements in either direction at a rate of 76 in. per minute. It is available at all times, obtained by pressing a switch.

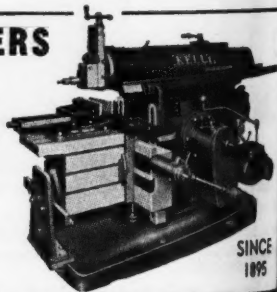


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Made in six sizes from 16" to 36" stroke, with motor or single pulley drive. Timken Bearings throughout. Revolving Table. Semi-automatic pressure lubrication. Centralized control. Stroke and feed adjustment during operation. Thoroughly guarded to protect operator and machine. Attractive prices.

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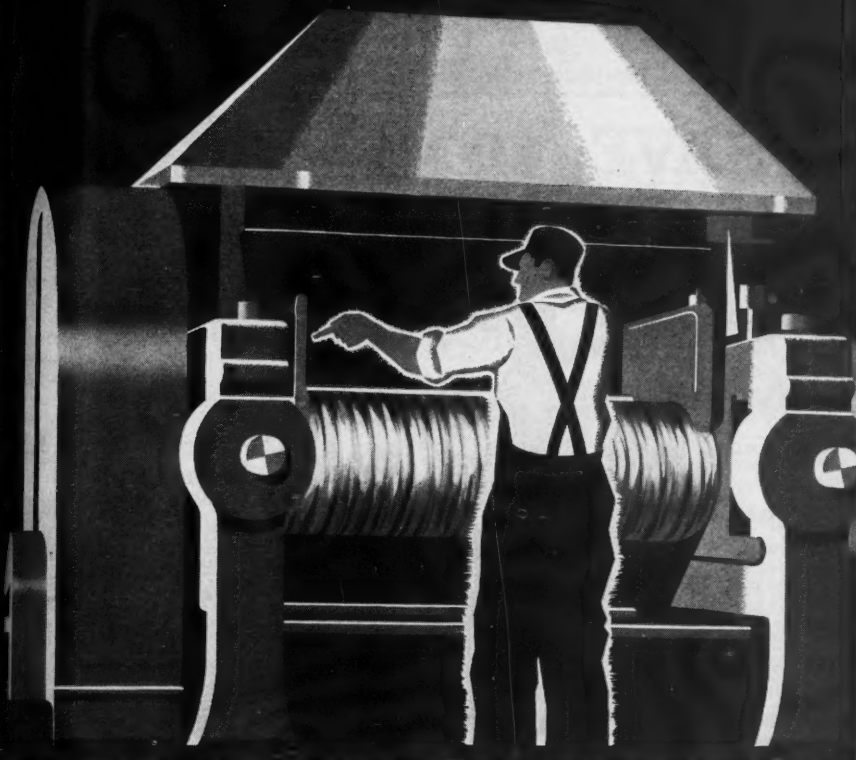
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SINCE
1895

April, 193



CAST IRON AND CONFIDENCE

A Molybdenum addition to cast iron has often proved the best way to get the most out of money spent to improve materials.

The selection of a gray cast iron with 0.75% Moly for 64-inch rubber mill drives is a typical example. The Moly iron is strong (a test showed 61,000 p.s.i.) and tough enough to stand severe service. Despite the necessary hardness, machining presents no difficulties. Thus full advantage is taken of the economy of cast

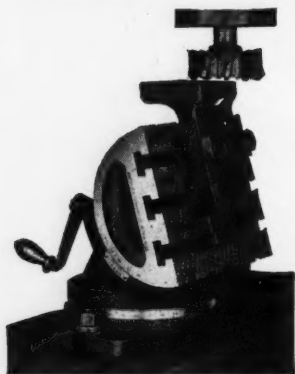
iron, without sacrifice of performance capacity.

This is only one of the many cases in which Molybdenum iron has brought about a combination of economy with dependability. Investigation may show that you can apply it with advantage. Our technical book, "Molybdenum in Cast Iron," is free to interested production executives and engineers on request.

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Here's an accurate tool used on drill presses, milling machines, grinders, planers and shapers. Graduated to 360° horizontally and 120° vertically with vernier adjustments. Eliminates costly fixtures and increases production. Write for catalog and prices.

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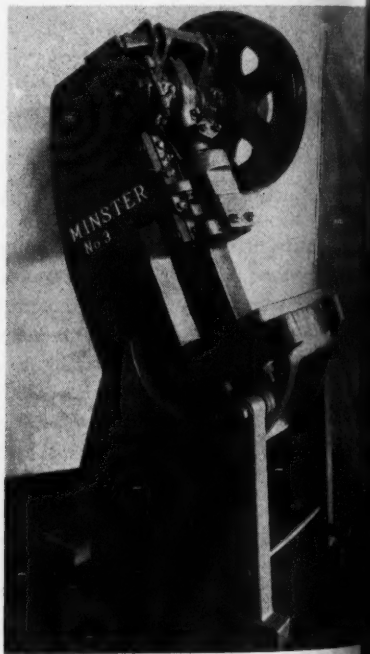
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ROSLINDALE • BOSTON, MASS.

button at the front of the knee. When the button is released, the table resumes its original feed movement.

A coolant tank with a capacity of 5 gallons is cast in the base. All driving mechanisms within the column are automatically lubricated by a plunger pump, oil being filtered each time it circulated. Floor space required, 62½ in. Standard equipment includes the main driving motor, fast travel motor, electrical controls and wiring. No. 22F flanged vise, coolant drip can, four screws for attaching adapters, spindle end, draw-in bolt, and set wrenches.

No. 3 Minster Open Back Inclinable Press

The Minster Machine Company, Minster, Ohio, offers a line of open back inclinable presses in nine sizes, ranging in capacity from 12 to 113 tons. The frames are of a high tensile strength alloyed semi-steel cast construction.



No. 3 Minster Open Back Inclinable Press

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in All NOPAK Air Cylinders Eliminate Costly Metal-to-Metal Impact

... what's more, the new type, NOPAK Air Cylinders, with Non-adjustable, pneumatic cushion-stop, sell in the *same price range as non-cushioned cylinders!*

Now, instead of choosing between cushioned and non-cushioned cylinders, you choose between adjustable and non-adjustable cushion heads. Whichever you specify, you are sure of relief from noisy, wearing, piston-hammering, longer life for pistons, and cup-leathers, lower maintenance costs, and smoother, more efficient performance.

Both types of NOPAK Cushioned Air Cylinders have Special Composition Cup Packing and extra-wide piston bearing to protect cups from excessive wear and friction. Write for New Illustrated Bulletin.

GALLAND-HENNING MFG. CO.

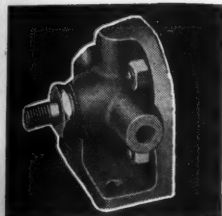
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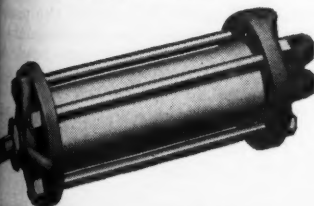
VALVES and CYLINDERS

A 2436-1P

MODERN MACHINE SHOP 139

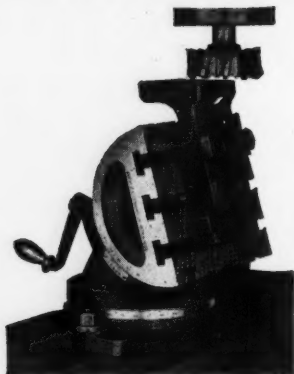


NOPAK Cylinder Head with built-in, non-adjustable air cushion. Adjustable head can be furnished on one end only, if desired.



NOPAK Cushioned Air Cylinder with Pendulum Mounting. All standard mountings available.

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Universal Angle Plate

Here's an accurate tool used on drill presses, milling machines, grinders, planers and shapers. Graduated to 360° horizontally and 120° vertically with vernier adjustments. Eliminates costly fixtures and increases production. Write for catalog and prices.

U. S. AUTOMATIC BOX MACHINERY CO., INC.

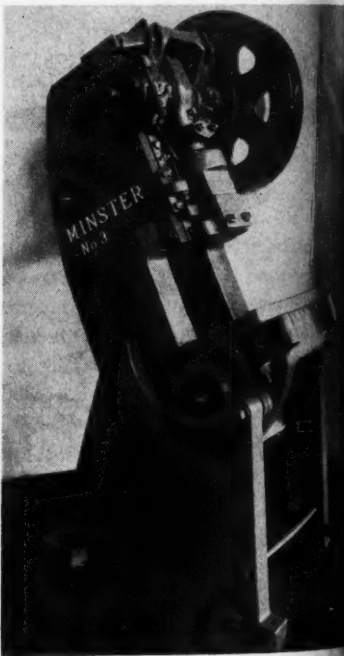
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button at the front of the knee. When the button is released, the table resumes its original feed movement.

A coolant tank with a capacity of 10 gallons is cast in the base. All drive mechanisms within the column are automatically lubricated by a pressure pump, oil being filtered each time it circulates. Floor space required, 62½ in. Standard equipment includes the main driving motor, fast travel motor, electrical controls and wiring. No. 22F flanged vise, coolant drip on four screws for attaching adapters at spindle end, draw-in bolt, and set wrenches.

No. 3 Minster Open Back Inclinable Press

The Minster Machine Company, Minster, Ohio, offers a line of open back inclinable presses in nine sizes, ranging in capacity from 12 to 113 tons. The frames are of a high tensile strength alloyed semi-steel cast construction.



No. 3 Minster Open Back Inclinable Press

AIR CUSHIONS

in All NOPAK Air Cylinders Eliminate Costly Metal-to-Metal Impact

... what's more, the new type, NOPAK Air Cylinders, with Non-adjustable, pneumatic cushion-stop, sell in the *same price range as non-cushioned cylinders!*

Now, instead of choosing between cushioned and non-cushioned cylinders, you choose between adjustable and non-adjustable cushion heads. Whichever you specify, you are sure of relief from noisy, wearing, piston-hammering, longer life for pistons, and cup-leathers, lower maintenance costs, and smoother, more efficient performance.

Both types of NOPAK Cushioned Air Cylinders have Special Composition Cup Packing and extra-wide piston bearing to protect cups from excessive wear and friction. Write for New Illustrated Bulletin.

GALLAND-HENNING MFG. CO.

2758 S. 31st STREET
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NOPAK

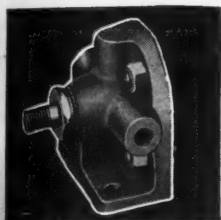
VALVES and CYLINDERS

A 2436-1P

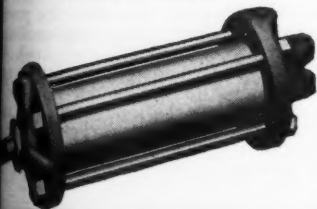
MODERN MACHINE SHOP 139



NOPAK Cylinder Head with built-in, non-adjustable air cushion. Adjustable head can be furnished on one end only, if desired.



NOPAK Cushioned Air Cylinder with Pedulum Mounting. All standard mountings available.



The upper part of the frame is of box-type construction with 45 deg. overhanging crankshaft bearings.

True ring nickel bronze bushings are used for the crankshaft bearings and tapered anti-friction bearings are used on the drive shaft and clutch wheel.

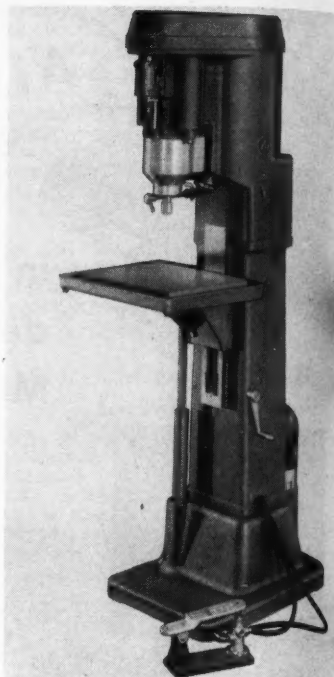
The slide and gib designs have been changed to incorporate longer ways, increased bearing surface, stronger slide and renewable nickel bronze ball and socket bushings in the slide. The brake on the positive clutch presses is designed to give long life, constant, uniform brake torque, and low operating temperature under extreme conditions. The brake shoe is a two-piece assembly, lined with four segments of oil-proof molded lining and finned to aid heat radiation.

The Multi-Engage Spline Clutch, having 10 to 22 points of engagement depending on the size, is standard equipment on these presses. Sizes No. 7, 8 and 9, in the geared type presses, can also be furnished with the Minster combination multiple disc friction clutch and brake.

Haskins No. 3 Vertical Air-Controlled Tapping Machine

The R. G. Haskins Company, 619 S. California Ave., Chicago, Ill., announces the development of a tapping machine in which the operation is entirely air controlled for the purpose of securing the utmost in sensitivity and accuracy as well as speed of operation. This high speed precision tapper is to be known as the Haskins No. 3 Vertical Air-Controlled Tapping Machine. The motor is stationary, driving the tap head through a V-belt and multi-speed pulleys.

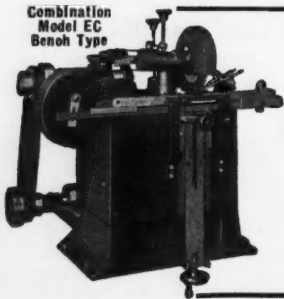
Compressed air controlled by an au-



Haskins No. 3 Vertical Air-Controlled Tapping Machine

tomatic air valve furnishes the pressure required for both the tapping and reversing strokes of the tap head. The automatic valve also controls the speed with which the tap is fed into and reversed out of the part. A foot pedal unit enables the operator to start or stop the tapping cycles, which are under control of the automatic valve. The

Combination
Model EC
Bench Type



SHARPEN YOUR OWN SAWS

**SAVE OVER 80% ON SHARPENING
HACK, BAND, CIRCULAR SAWS**

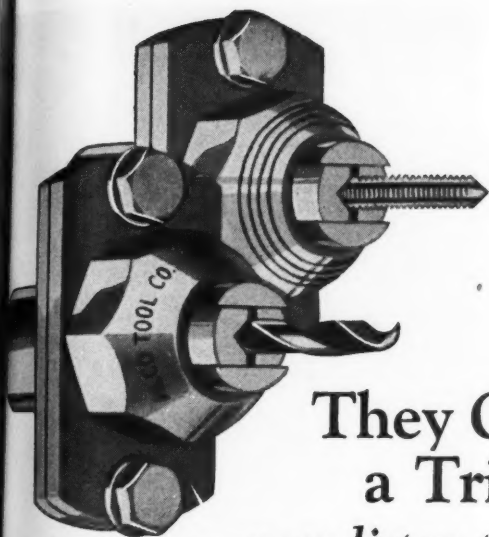
The **WARDWELL SAV-A-SAW** automatically sharpens saws with teeth as fine as 32 to the inch at a speed up to 75 per minute. Savings on 2 gross of blades will pay for the machine. Assures keener cutting saws at extremely low cost.

Write for complete information

THE WARDWELL MFG. CO.

3166 FULTON RD.

CLEVELAND, OHIO



They Gave Them a Trial---

PATENTS PENDING *now listen to their praises*

Here's what just a few enthusiastic users have to say about ALCO Drill Chucks and ALCO Tap Holders:

Automobile Manufacturer—"They are the best tools we have ever used for this class of work."

Machine Manufacturer—"Your tap holders certainly receive favorable comment from our manufacturing division."

Instrument Manufacturer—"A study was made of your tap holders for operation and we are pleased to advise the result was better product, less tap breakage and increased tap life."

Navy Yard—"Your drill chucks are so acceptable our operators dislike using previous type with bushing."

Scale Manufacturer—"We are constantly replacing our old type drill holders with ALCO drill chucks and our bushing worries are decreasing."

Watch Manufacturer—"The Accuracy of your drill chucks makes it possible to drill the small holes required in our industry."

Many other users have written us with equal enthusiasm. These include many of the most important manufacturers in the country and abroad. We have yet to hear from one who has failed to effect economies, to "speed-up" his output and improve the quality of his work. Write today for detailed information and prices. Alco Tool Company, Bridgeport, Connecticut, U.S.A.

ALCO TOOLS

EFFICIENT

machine will operate in continuous cycles as long as the air valve is held open. It can also be used intermittently by operating the foot pedal and then releasing it to produce one complete cycle.

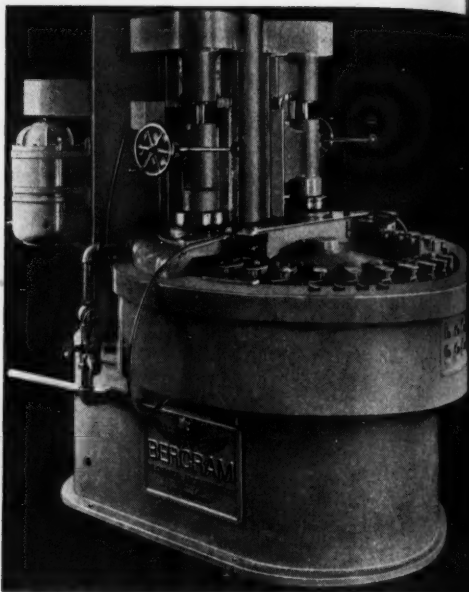
The tapper lends itself to the feeding of parts into a simple holding fixture or a magazine fixture. It is also adapted to hopper feed, dial feed, or other specially designed fixtures.

Bergram Type SG Production Surface Grinding Machine

To meet a demand for greater capacity and improved production over the previously offered Type DG-1 Machine, the Type SG Production Surface Grinding Machine illustrated here has been designed by Bergram Mechanical Engineering Co., New Britain, Conn.

Automatically - operated fixtures of a number and type determined by the nature of the work are mounted on a revolving table which passes underneath the grinding wheels for stock removal in selected steps to a uniform height. The grinding spindles are driven by individual motors through variable speed devices and the table has an individual motor drive through a variable speed device, thus providing selection of proper work speed and wheel speeds.

Diamonds for dressing the wheels are adjustably mounted on the table. Feed of the wheels is provided for hand, au-



Bergram Type SG-1 Production Surface Grinding Machine

tomatic or push button control operation. Grinding wheels from 8 to 10 in. in diameter can be accommodated on this machine. The work table is 18 in. in diameter. The machine shown is arranged for wet grinding with work holding fixtures which close during the grinding portion of one revolution, and open for ejecting or loading for the remainder of the revolution.

The machines can be built to handle workpieces of any height. For facilities in setting up or changing over from one job to another, a complete assembly



BROACH and ASSEMBLE

At left: Self-contained 4-ton Greenard Hydraulic Arbor Press adaptable for assembling, broaching, burnishing, etc. Adjustable ram stroke from 1/2" to 16".

At right: 12-ton Bench Press.

We also make 65 styles of Rack and Pinion Presses. Hydraulic Presses from 1 1/2 to 15 tons capacity. Write for details.

GREENERD ARBOR PRESS CO., INC.

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**BETTER,
SILENT
GEAR
MATERIAL**



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operate with perfect smoothness and silence. Therefore on production jobs they reduce costs, and they make things easier for salesmen because quiet machines are easier to sell. Maintenance men prefer that the machines in their care operate silently and smoothly and FORMICA gears are a big help. The next time you need replacement gear one of the gear cutters named can give you prompt service.

THE FORMICA INSULATION COMPANY

200 SPRING GROVE AVENUE

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- The Union Gear & Mfg. Co., Boston, Mass.
- Chicago Rawhide Mfg. Co., Chicago, Ill.
- Perfection Gear Co., Chicago, Ill.
- Gear Specialties, Inc., Chicago, Ill.
- Merkle-Korff Gear Co., Chicago, Ill.
- Chicago Gear Works, Chicago, Ill.
- Forme Gear Works, Cicero, Ill.
- The Cincinnati Gear Co., Cincinnati, Ohio
- Clarksville Foundry & Machine Co., Clarksville, Tenn.
- The Horburgh & Scott Co., Cleveland, Ohio
- The Stahl Gear & Machine Co., Cleveland, Ohio
- The Master Electric Co., Dayton, Ohio
- Boal Foundry & Machine Co., Ft. Smith, Ark.
- C. A. Lawton Company, DePere, Wis.
- The Adams Company, Dubuque, Iowa
- Hofft Machine Co., Green Bay, Wis.
- Hartford Special Mch'ny Co., Hartford, Conn.
- Beary Machine Works, Keokuk, Iowa
- The Generating Gear Co., Milwaukee, Wis.
- Badger State Gear Co., Milwaukee, Wis.
- Precision Machine Co., Milwaukee, Wis.
- E. A. Prash Co., Minneapolis, Minn.
- Joaquin Germany Lopez, Havana, Cuba
- The S&S Machine Works, Kansas City, Mo.
- Kennedy & Bowder, Nashville, Tenn.
- Natick Gear Works, Brooklyn, N. Y.
- New Jersey Gear & Mfg. Co., Newark, N. J.
- Prager, Inc., New Orleans, La.
- J. Morrison Gilmore, New York City, N. Y.
- New York City, N. Y.
- Mid-State Electrical Engineering Co., Ocoee Mills, Pa.
- Paritan Machine Co., Omaha, Neb.
- E. M. Smith Machine Co., Peoria, Ill.
- The Eagle Gear & Machine Co., Philadelphia, Pa.
- The Pittsburgh Machine & Supply Co., Pittsburgh, Pa.
- Perkins Machine & Gear Co., Springfield, Mass.
- Winfield H. Smith, Inc., Springfield, N. Y.
- Alling Lander Company, Sodus, N. Y.
- Charles E. Crawford Gear Corp'n., South Easton, Mass.
- Arlington Machine Co., St. Paul, Minn.
- Farrell Mfg. Co., Toledo, Ohio
- Dieffendorf Gear Corp., Syracuse, N. Y.
- Barson Cook Co., West Point, Ga.
- Worcester Gear Works, Worcester, Mass.
- Maschinenbau Gear & Tool Co., Woburn, Mass.

Millionth

*part of an inch
accuracy with
chrome plate*



Chrome — PLATED — GAGE BLOCKS



**DEARBORN
GAGE COMPANY**

*"Originators of Chromium Plated
Gage Blocks"*

22035 Beech Street
DEARBORN - MICHIGAN

fixtures is permanently mounted on a ring as a unit which is bolted to the table so that it can be readily removed and replaced by another unit. Spindle column and base are of welded steel construction, designed with internal ribbing to provide maximum rigidity and minimum deflection.

The machine is built in two sizes, Type SG-1 and Type SG-2. The Type SG-1 Machine takes a grinding wheel 8 x 3½ x 6-in. hole to operate at a maximum of 2,700 r.p.m. and minimum of 900 r.p.m. Motor required, 5 h.p., 1,800 r.p.m. Center of work table center of work when mounted in chuck 19-in. radius. Work table motor, 1 h.p., 1,200 r.p.m. Work table speed, variable ¼ to 1 r.p.m. Floor space required 60 x 80 in. Weight, 8,000 pounds.

The SG-2 machine takes a grinding wheel 6 x 3 x 4-in. hole. Motor required 3 h.p. at 1,800 r.p.m. Work table motor 3 h.p., 1,200 r.p.m. Work table speed ¼ to 1 h.p. Floor space, 54 x 74 in. Weight, 6,500 pounds.

Monoset Tool Grinder

The Monoset Small Tool Grinder is being built by Chittenden Corporation, 5005 Euclid Ave., Cleveland, Ohio, said to combine all of the mechanical movements required to produce any desired geometrical tool or form which can be produced by grinding. It is said to make possible the quick and inexpensive production of many types of tools by grinding from solid hardened blanks without preliminary machining, as well as the economical reconditioning of tools to extend their life. Without attachments and with single chucking, the unit permits the completion of work usually requiring several set-ups and the use of as many as five individual machines.

The Monoset Grinder generates spirals, right or left hand, straight or taper, 0 to 1½ turns per inch, male or female radii, concentric or eccentric with instant dial setting and with gears to change. When reconditioning spiral tools, if the spiral lead is known the dial is simply set at the change graduations; if unknown, the lead may be picked up by means of a work feeler or finger. After spiral lead is found the feeler is rotated away from the work and the work head spindle rotation is then responsive to table movement. Rests are provided which make it possible to grind uncentered stock even very small diameters. The fin-



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Every Johnson General Purpose Bearing is cast in S. A. E. 64—Copper 80%; Tin 10%; Lead 10%. This alloy combines, in the correct proportions, all the necessary elements to insure the greatest performance.

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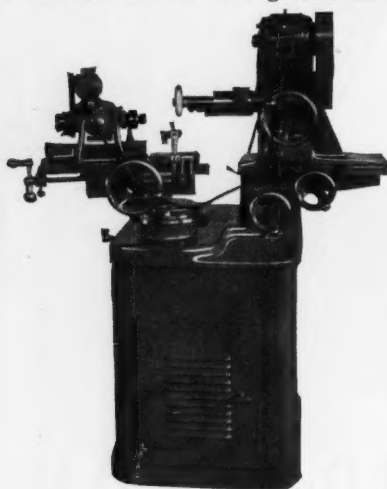
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and the location of
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JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

590 S. MILL STREET • NEW CASTLE, PA.

diameter, any desired amount of lip clearance, and face are ground at a



Monoset Tool Grinder
single setting.
All spindles of the Monoset Tool

Grinder are of heat treated high alloy steel and are mounted in precision ball bearings, constant and fully sealed. All slides are shrouded and all operating mechanism is housed. Castings used are of Meehan metal. The base is of welded steel with ventilated door and tool shelves. Advanced motors are used, of sealed bearing construction. Collets are highest grade tungsten alloy and heat treated to assure accuracy and durability. Lubrication is constant and uniform.

The turn table can be rotated 220° in a horizontal plane. The work head tilts 45 deg. above or below center. The work can be fed to the wheel or the wheel to the work as desired. Outside and inside diameters can be ground in a single setting. Main spindle can be centered in either vertical or horizontal plane instantly. The base is 25 x 36 in. and the floor space required is 5 x 6 ft. Height from floor to center of work head spindle, 45 in. Spindle motor, 1/2 h.p., 110 volt, 60 cycle, A.C., 1725 r.p.m. Work head motor, 1/15 h.p., universal type; speed, 200 r.p.m. Maximum swing over carriage, 9 in. Outside slide movement, 2 1/2 in. either side of

COMET

Internal Threading and Boring Tools

(For holes from 1/8" upwards 15 Different Sizes)

The accurate thread angle is maintained through each sharpening until tool is entirely worn down. Small head—long cutting surface for regrinding.

Agents wanted!

Write for complete data.
COMET TOOLS INC.
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Here's Where AMERICA'S AIR SUPREMACY Begins



with Cushman PRECISION Chucking Methods
for ACCURACY and SPEED in Machining Vital Aircraft Parts

If there is one place in a plane where slight inaccuracy . . . a thousandth of unwanted play; a fraction of unbalance . . . can cause all kinds of serious trouble, that place is in the propeller.

The picture above shows the set-up for machining the vital hub surfaces of controllable pitch propellers in America's most famous propeller manufacturing plant. The chuck is a standard Cushman Precision 4-jaw combination chuck . . . a chuck that, because of exceptionally fine design and the precision methods used throughout its manufacture, will hold initial latched centering accuracy throughout long daily production line service.

If you would be familiar with the preferred precision chucking practices of the World's leading metal working industries, send for and study the Cushman Catalog . . . 104 pages of listings, blue prints and engineering data covering both standard and new types of chucks.

The Cushman Chuck Company, Hartford, Conn.

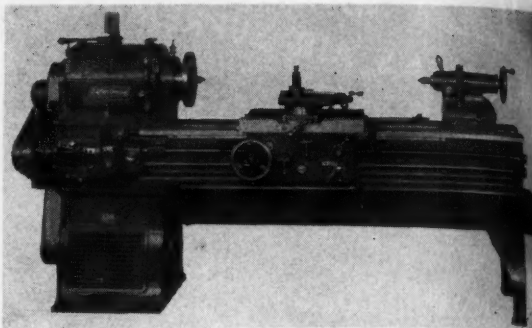
A world standard for PRECISION

CHUCKING
ENGINEERS
Since 1862

center. Transverse slide movement, 6 in. Longitudinal, 7 in. Main spindle speed, 8,000 r.p.m. High spindle speed, 35,000 r.p.m. Approximate shipping weight, crated, 1,000 pounds.

16-In. Rockford Economy Lathe With Hollow Spindle Headstock

To meet the requirements of a customer, Rockford Machine Tool Company, Rockford, Ill., recently equipped a standard 16-in. Rockford Economy Lathe with the headstock shown in the illustration. The feature of the headstock is a hollow spindle having a 4-in. bore. Following the standard design of the Rockford Geared Head Economy Lathe, this hollow spindle headstock has full Timken bearings. The carriage of the lathe is equipped with drop lever control to longitudinal and cross feeds.



16-In. Rockford Economy Lathe with Hollow Spindle Headstock

With the exception of a slight increase in swing and a slight decrease in maximum spindle speed, the specifications of this machine are essentially the same as the standard 16-in. Economy Lathe. The hollow spindle lathe has speeds of from 15 to 296 r.p.m. with drive pulley speed of 385 r.p.m. The lathe is particularly adapted to light hollow spindle work such as operation on tubing where cuts are relatively light and diameters relatively large.

LOW COST

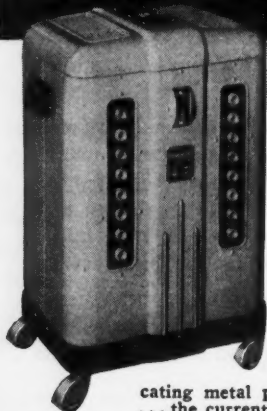
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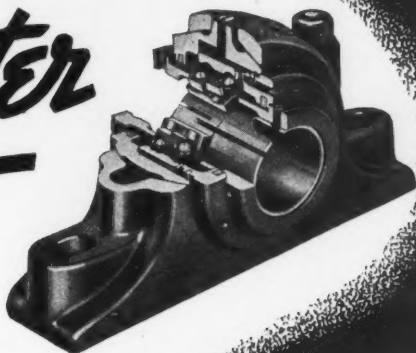


LOW FIRST COST Three models at the reasonable prices: \$155, \$195 and \$225. All models fully equipped ready for use...includes power cable, two welding cables, helmet, electrode holder and an assortment of electrodes...nothing extra to buy.

LOW OPERATING COST A. C. Arc Welding is by far the cheapest method of repairing or fabricating metal parts. A. C. Arc Welding produces strong, dense, ductile welds...the current automatically and continuously reverses polarity puddling molten metal thus floating impurities to the top where they form a slag. Marquette A. C. Arc Welders are listed by Underwriters' Laboratories, Inc. For complete information write Dept. E

MARQUETTE MANUFACTURING CO., Inc. MINNEAPOLIS MINNESOTA

Character



PERFORMANCE

SPECIFY **CJB**

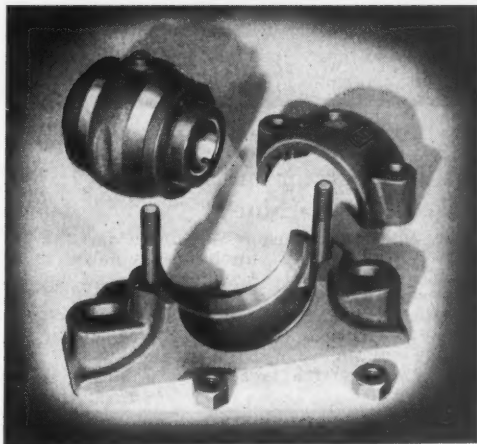
PILLOW BLOCKS

THE COMBINATION of qualities found in this ball and socket, self-aligning pillow block distinguish it from ordinary designs. They make them valuable for jobs where performance and dependability are paramount.

Ball and socket design—easier to install—easier to align—maximum alignment.

Maximum ball type double row bearing. Great radial capacity—extra thrust capacity—smooth running—high speeds.

Patented adapter type shaft lock—full contact on shaft—positive lock—centers shaft—no vibration—assures full capacity of bearing.



Labyrinth type seals—most efficient—keep out dirt—retain lubricant.

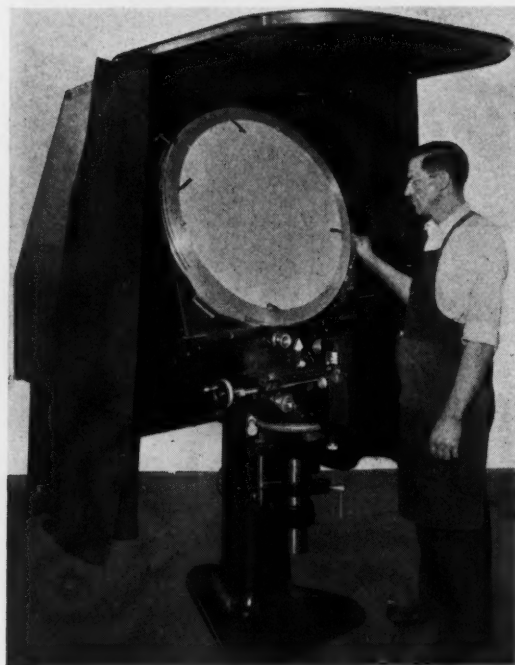
Made in $1\frac{3}{16}$ to 4 inch shaft sizes.

AHLBERG BEARING COMPANY

Manufacturers of **CJB** Master Ball Bearings

3029 West 47th Street

Chicago, Ill.



J&L Comparator and Measuring Machine

J&L Comparator and Measuring Machine

The Jones & Lamson Machine Company, Springfield, Vt., announces a new model of the J&L Comparator and Measuring Machine which has a 30-in. diameter screen, thus permitting the optical inspection of large objects at suitable magnification. Typical parts for which the machine is suited are large

form tools, cutters, hobs, and gages, as well as products. The following lenses will be furnished: 20X lens which will project a 1½-in. area object; 30X lens which will project a 1-in. area object; 40X lens which will project a ¾-in. area object, and 100X lens which will project a 0.3-in. area object.

The periphery of the 30-in. diameter ring, which supports the screen, is graduated one-half degrees, reading to the vernier to one minute arc. This machine will accommodate objects 8 in. in diameter by 21 in. long and has provisions for measuring 4 in. the co-ordinates.

The machine is furnished with any one of three types of table; plain table without lateral adjustment, table with 8-in. lateral travel, and table with 8-in. lateral travel. The table may be swiveled to position the helix of hobs and to normal to the axis of the lathe system.

Lead measurements on the tables with lateral travel may be accomplished by the use of the micrometer attached to the table, by spacing blocks or measuring bars. An attachment can be supplied for measuring by reflecting those surfaces which cannot be projected.

"High Speed" Four-Speed Drilling Machine

The High Speed Hammer Co., Inc. Rochester, N. Y., who have manu-

Cullman Sprockets for

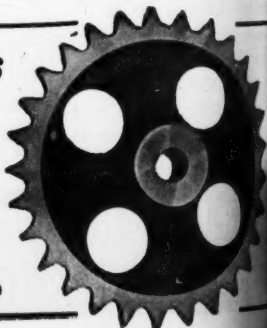
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BUCKEYE BEARINGS

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YOU'LL FIND THEY RUN BETTER, TOO!

Selecting in every detail the many advantages of Buckeye exacting metallurgical standards and skillful manufacture, Buckeye Bearings will give you a maximum of satisfactory service. Customers say they are a premium product—yet they sell at the standard price. That's why hundreds of manufacturers specify—and insist on getting—Buckeye Bushings. • Send for the Buckeye Catalogs. They list 787 standard sizes of ready-to-use bushings—154 sizes of cored and solid bars, ideal for maintenance work—and 233 sizes of electric motor bearings. Then, like other companies, you too can order Buckeye Bushings—from stock from the 18 warehouses located at strategic points from coast-to-coast. No obligation. Send for the catalogs today.



SEND FOR THE BUCKEYE CATALOGS

Catalog 137 lists 787 sizes of ready-to-use industrial bushings and 154 sizes of cored and solid bars. Catalog "O" lists 268 sizes of Electric Motor Bearings. Sent on request. Write today.

Write Cleveland direct on blue print and specification requirements.

No order is too big or too small for Buckeye

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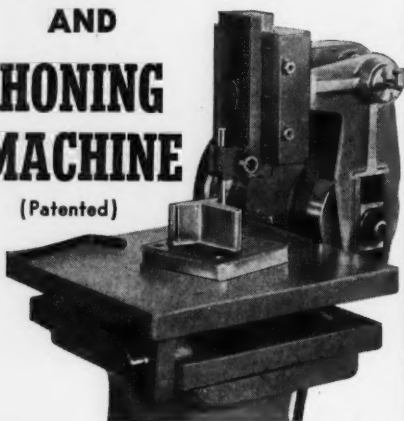
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FILING AND HONING MACHINE

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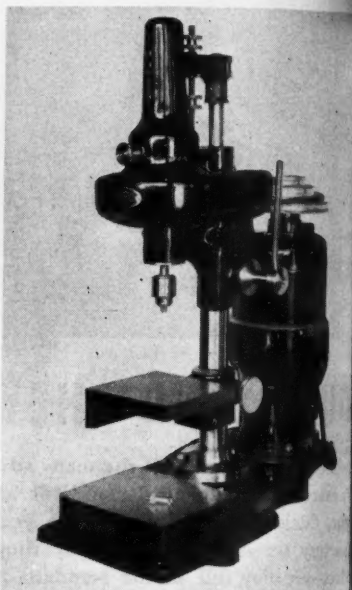
Machine finish your punches.
Eliminate the slow, tedious hand
method.

Guaranteed to cut your cost.
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tured the two and three-speed Mod-
R-53 Precision Drilling Machine for
number of years, are now adding
four-speed machine to their line. The
speeds of the machine are 750, 1,500,
3,000 and 6,000 r.p.m. The range of the
machine is from No. 80 to 1/4-in. drill
Holes of 0.010-in. diameter have been
successfully drilled with it.

Because of an increasing demand for
a sensitive drilling machine with



"High Speed" Four-Speed Drilling Machine

proper speed for tool steels, stainless
and other tough alloy steels, the ap-
propriate speed of 750 r.p.m. was added to
the other three speeds. This speed is
also useful in certain drilling operations
in slate and other non-metallic ma-
terials.

"American" Geared Taper Turning Mechanism

The geared taper turning mechanism
recently developed by The American
Tool Works Company, Cincinnati, Ohio,
for application to Super-Product
lathes is designed to turn tapers within
a moderate range of diameters on any
length of work up to the full center

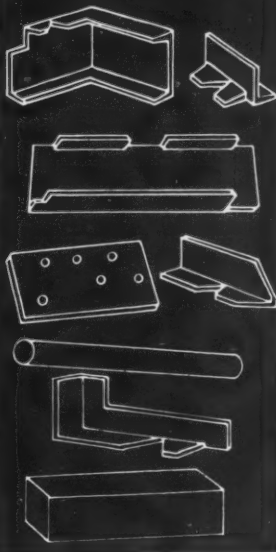
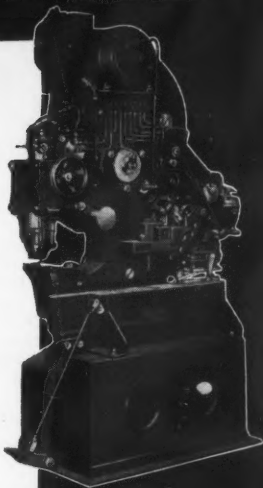
THIS *Buffalo* UNIVERSAL IRON WORKER DOES MANY JOBS WELL

For instance, you can do punching, bar shearing, angle shearing, plate slitting, coping, and notching on this one machine. You can work angles, flats, rounds, squares, and flat steel.

Just think what you can save in production costs over hand methods of doing such work with this modern industrial plant.

You will also be impressed with its clean, accurate work, even on the roughest jobs.

And because of its rugged construction, its "Armor-Plate" electrical-welded frame, a Buffalo Universal Iron Worker will continue to pay dividends long after its cost has been written off the books.



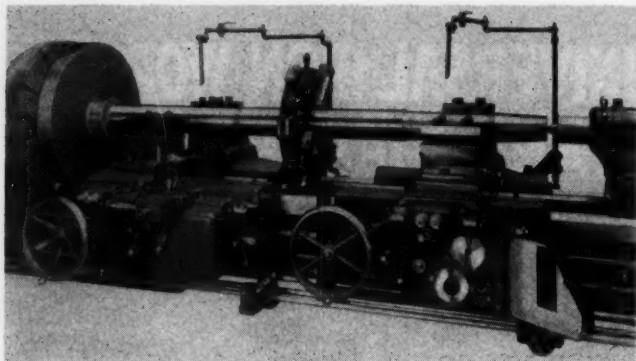
MAY WE SEND YOU BULLETIN 331-A?

Buffalo Forge Company

100 Broadway

Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



"American" Lathe with Geared Taper Turning Mechanism

distance capacity of the lathe.

With the geared taper turning mechanism, the taper on the work is produced by the simultaneous functioning of the longitudinal and the cross feeding mechanisms, the various degrees or rates of taper being determined by the relation of the length of carriage travel to the rate of cross feed of the tool slide.

The cross feed rate is determined by

the standpoint of operation and control of the mechanism for change over from straight to taper turning vice versa. This is accomplished by plunger lever shown at the left side of the carriage bridge.

Suitable pinions on the cross screws form the means of cross feeding for either front or rear turn rests, separately or simultaneously power or hand feed. Both rests can

a series of change gears mounted on a suitable apron in the spindle. The change gears are enclosed in a hinged cover which, when swung open, enables easy access to the gear mechanism. The taper turning mechanism is actuated through the spindle rod and the regular apron gears.

An outstanding feature of the apron is its simplicity, both in

Faster Cutting Easier Working Longer Lasting

Swiss Pattern Files made in the U. S. A.
Made of the highest grade file steel,
(Not tool steel.)

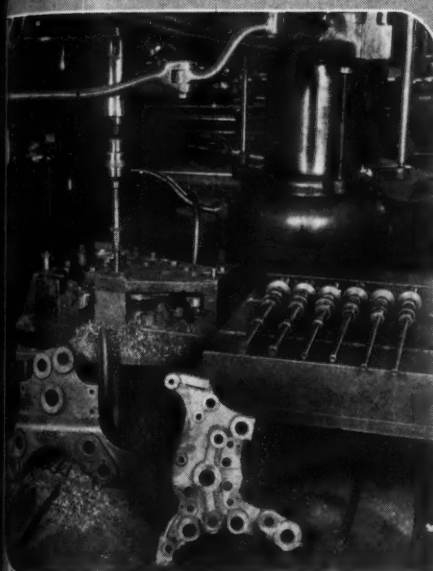
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AMERICAN SWISS FILE & TOOL CO.
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SWISS PATTERN FILES AND RIFFLERS

DAVIS BORING TOOLS



are Very
ECONOMICAL
and
EFFICIENT"
Gays

**HARRIS,
SEYBOLD &
POTTER**
CLEVELAND, OHIO

Davis "L" type Micrometer Expansion type cutters on bars have proved very economical and efficient in this set-up. All bars are used in a quick-change chuck, and are piloted in a fixture both above and below the work.

The universal application of Davis "L" type bars is clearly

illustrated by the many different size holes which are bored in these parts, all of which are rough and finish bored to size with Davis tools.

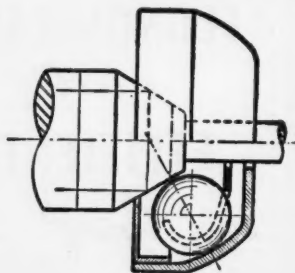
Send us prints of *your* special or unusual work and, without obligation, we will submit you a helpful, specific recommendation.

DAVIS BORING TOOL DIVISION
Larkin Packer Company, Inc., St. Louis, U. S. A.

DAVIS BORING TOOLS

R. M. B.

Miniature BALL BEARINGS



Enlarged 24 times.

**OUTSIDE DIAMETERS
from .060"**

Ideal for small motors, recorders, clock-work mechanism, weighing devices, speed indicators, pressure gauges, etc. R. M. B. Bearings minimize friction and at the same time produce a durable and sturdy product.

Types suitable for radial, axial or angular loads or for use with conical pivot.

These bearings withstand relatively severe shocks because the balls travel on the spherical portion of the race. Easy to mount and adaptable to a wide variety of design requirements.

Write for Catalog No. 2 which contains complete information on design, properties and dimensions.

LANDIS & GYR, Inc.

104 FIFTH AVE.

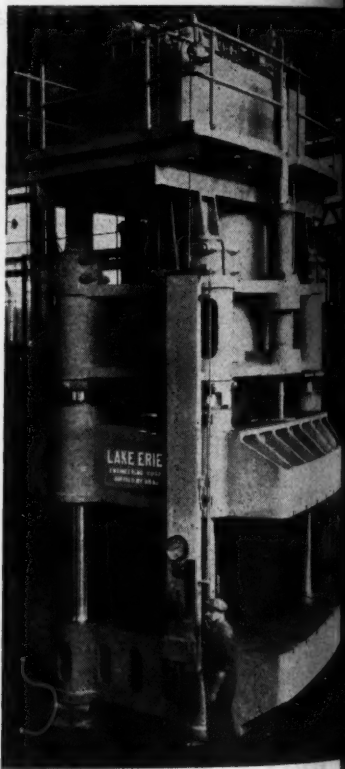
NEW YORK

operated separately or simultaneously for either straight or taper turning. Convenient hand adjusting means provided for either tool slide.

When turning taper work, the cut is done from the small end at the stock to the larger diameter at the head end, the tools feeding away from the work axis. If the direction of carriage longitudinal feed is reversed, tools will feed in toward the center.

Lake Erie 2,500-Ton Hydraulic Press

The 2,500-ton capacity Lake Erie hydraulic Press illustrated herewith is one of 14 built by the Lake Erie Engineering Corporation, Buffalo, N. Y.



Lake Erie 2,500-Ton Hydraulic Press

QUALITY IS MORE THAN SKIN DEEP

SO WE LOOK DEEP UNDER THE SURFACE

OF OUR SPECIAL PARKALOY ROD

With the finest of metallographic equipment at hand, the Parker-Kalon Laboratory can look right into this special nickel alloy. Make sure that grain size, carbon content and structure are 100 percent correct.

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erewith is
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N. Y.

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SOCKET SCREWS

There's no guessing about their properties. The photomicrograph magnifies grain size and other structural characteristics to 1000 diameters. Tells whether product meets higher standards set by Parker-Kalon.

Example of the QUALITY-CONTROL that leads critical buyers to demand PARKER-KALON

Visit the \$250,000 Parker-Kalon Laboratory and you'll understand how Parker-Kalon produced Socket Screws that set a new standard of quality. And why every Parker-Kalon Cold-forged Socket Screw possesses ALL essential qualities.

Unequaled in the screw industry, this laboratory with its Quality-Control facilities guarantees perfection. Get free samples—put them to any test.

PARKER-KALON CORP., 198M Varick St., New York

PARKER-KALON



SOCKET SCREWS

Alle Press

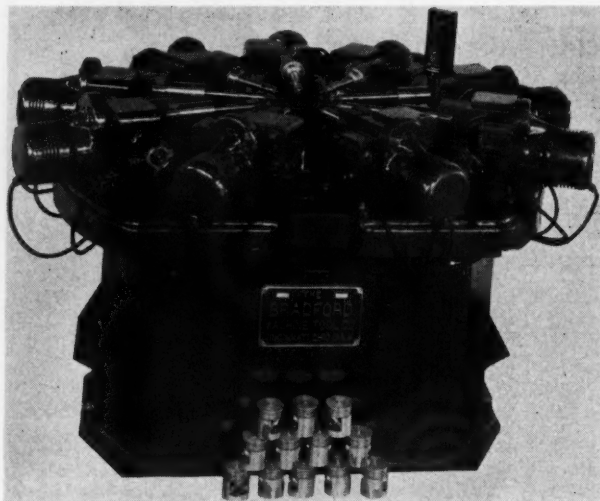
April, 1939

MODERN MACHINE SHOP

157

forming duralumin sections of airplane wings, pontoons, and fuselage parts. The press illustrated weighs 392,000 lbs. and required six freight cars for transportation.

The ram is 42-in. diameter and platens are 150 x 89 in. The press is a self-contained unit with electrically driven pumps mounted on its upper deck.



Bradford Nine-Unit Drilling Machine

Bradford Nine-Unit Drilling Machine

The Bradford Machine Tool Co., 657 Evans St., Cincinnati, Ohio, has developed a machine for the drilling of closely spaced small holes such as the "smoke" holes in automotive pistons which the machine in the illustration is

designed to handle. The pistons being drilled by this machine have 18 holes so spaced that it is impossible to drill them all simultaneously, therefore the machine is devised to drill 9 holes, automatically index the piston 180 degrees, and then drill the remaining 9 holes.

The machine consists of a welded steel base which also acts as the coolant collector and clean-out. On top of the base is supported a cast iron table with radial T-slots in which nine Bradford No. 0 automatic units are fastened, the method of mounting permitting future changes in the location of the small holes. The piston holding fixture is placed on a special developed, electrically operated index table actuated and controlled entirely by solenoids and limit switches. The master control of the machine is through a push button station at the operator position in conjunction with a control panel built into the machine at the rear of the base.

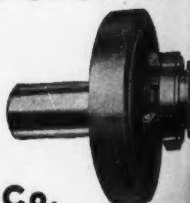
Synchronization of all movements is assured by electrical interlocks on all circuits, preventing any possibility of interference between the various functions of the machine either through breaking of some part of the mechanism or carelessness in the handling of the push button by the operator.

The machine is of anti-friction construction.

"EDGEMONT" SERVICE TESTED FRICTION CLUTCHES DISC "TYPE SF"



For the most severe jobs this clutch has won the unqualified approval of maintenance men. Its ability to stand up and take it is ample reason for giving it a trial on any drive. For high or low speed, easy or hard applications the "Type SF" is superior. Send now for circular showing the wide range of sizes.



The Edgemont Machine Co.
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JOHANSSON SET No. 1

(Accurate to $\pm .000008$ inch)

New Low Price
\$ **285**
ONLY

The 81 blocks of this set in combination form 120,000 gages, in steps of .0001 inch, from minimum size .200 inch to more than 12 inches. These blocks are also sold separately.

Johansson Blocks are available accurate to within $\pm .000008$ inch, $\pm .000004$ inch, or $\pm .000002$ inch.

Catalog No. 14 gives complete list of NEW LOW PRICES, blocks, sets and Johansson Accessories which protect and greatly increase the usefulness of Johansson Blocks. Mail the coupon for your copy.

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JOHANSSON DIVISION

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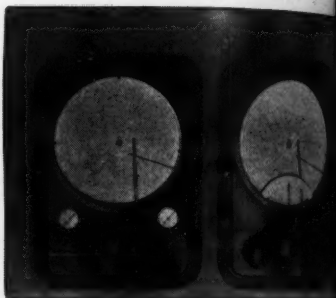
struction throughout, every bearing being either ball or roller type running in oil. Each of the nine automatic units is powered by a built-in $\frac{1}{2}$ h.p. 3,450 r.p.m. ball bearing fully enclosed motor. The power circuits are 440 volts, while the control circuits are provided with 110 volts through a heavy duty transformer built into the control panel. All motors, and also the indexing solenoids, are provided with individual thermal protection against overload and under-voltage.

Spindle speeds are 5,100 r.p.m., and indexing time for the 180 deg. index is less than one-half second. The machine finishes 600 pistons per hour, which is equivalent to 10,800 drilled holes. This extremely high speed of operation and synchronization required the timing of some of the synchronizing cycles to within one-tenth of a second which is said by the manufacturer to be impossible with any other method of control except electrical.

Bristol Flow Ratio Controller

The rate of flow of one fluid in definite ratio to the flow of a second fluid, automatically controlled, is accomplish-

ed by means of a Flow Ratio Controller developed by The Bristol Company, Waterbury, Conn. One of the features of the controller is an arrangement



Bristol Flow Ratio Controller

which permits changing the ratio any time by simply turning a knob on the outside of the case.

Thus, a 5:1 ratio between the flow of air and fuel gas, a 4:1 ratio between the flow of natural gas and artificial gas, a definite ratio between two different kinds of gasses in a furnace, or a definite ratio between the lean oil and

NEW!—Increase Punch Press Efficiency 60% to 75%

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SIMPLE TO OPERATE—ALL ADJUSTMENTS QUICKLY AND EASILY MADE

Adaptable To all types of die sets, and to almost all punch presses—will handle most all types of coiled stock

Economical Eliminates expensive feed-trouble jams. Die Feeder equipped dies quickly set and Low maintenance costs.

Accurate Positive feed control and absence of wearing parts maintain accuracy. Feed length adjustable from 0" to its maximum in increments of .01

Send for folder No. 82 giving complete story of this profit making device.

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282 WILBRAHAM ROAD

MFG. CO.
SPRINGFIELD, MASS.

Ratio Control
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April 1939

Diamonds...the World's Most Modern Saw Plant...Specifies AAF Dust Control

America's first completely AIR conditioned windowless factory—equipped with AAF dust control.

28 Type D Roto-Clones for dust control on grinding equipment and 2 Type W Roto-Clones for servicing sand blast cabinets.

More conscious than ever of the need for carefully engineered dust-control and air-filtration equipment, industry is finding a solution of its dust problems in standard AAF equipment—engineered to meet the requirements of specific industrial applications.

The American Air Filter Company's Engineering Department is available to you—without obligation—to study your Dust Control problem and submit recommendations. Address Dept. 123.

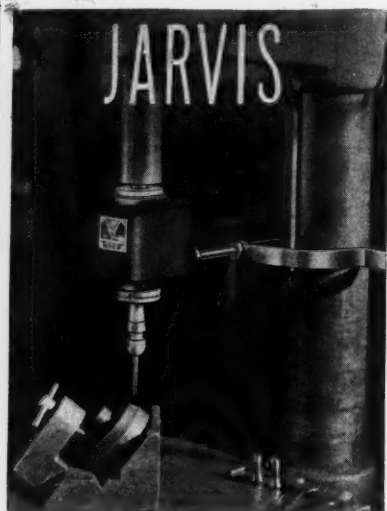
AMERICAN AIR FILTER CO., INC.
INCORPORATED
LOUISVILLE, KY.

AIR FILTRATION **AAF** DUST CONTROL

JARVIS

Latest Jarvis High Speed, all ball bearing, Tapping Attachments are standard equipped with adjustable spring locking side rods eliminating all vibration, and single purpose, positive grip collets. You can save with these high speed, all ball bearing Tapping Attachments.

Write for our catalog T-5.



Chas. L. Jarvis Co.

MIDDLETOWN • CONN.

wet gas entering an absorber, are some of the useful applications of these instruments.

As shown in the illustration, the Bristol Flow Ratio Controller consists of two instruments—one a standard Flow Recorder and the other a standard Flow Recorder Controller. The rate of flow is measured and recorded by one instrument, which also sets the control point on the second. The latter then records and controls the flow proportionately to the first, depending upon the ratio selected.

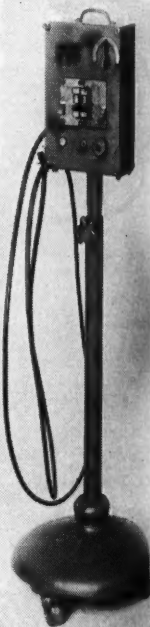
Laidlaw Model 110 Jr. Portable Band Saw Welder

Illustrated here is a portable band saw blade welder which is designed

to join together the ends of a band saw blade by resistance welding. The machine, product of William Laidlaw, Inc., Belmont, N. Y., is available in two sizes, known respectively as the Junior and Senior models. The Junior model will handle blades from 0.01 to 0.05 in. in thickness and from $\frac{1}{8}$ to $\frac{1}{2}$ in. in width. The Senior model will take the same thicknesses and has capacity in width from $\frac{1}{4}$ to 1 inch.

The transformer with which the machine is equipped can be supplied for 110 or 220 volts, 60 cycle, single phase, A.C. Both units are fitted with motor-driven grinding wheels to remove flash after the weld has been completed.

In the center of the machine panel is a pair of dies into which the two ends of the saw blade are inserted and clamped in position. In the upper right-



Laidlaw Model 110 Jr. Portable Band Saw Welder

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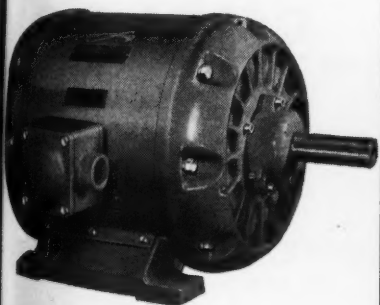
and corner is a pointer which is turn-
ed to the left for the spacing for the
and then to the right for tension.
The Push button is located in the lower
right-hand corner of the panel and is
pressed and held until the ends have
been brought up to heat and the weld
completed. The pointer is then turned
to "anneal" position and the blade is
clamped with the weld in the center
of the space between the two dies. The
push button is used intermittently until
the blades become a dull red color. The
rotating wheel is started and stopped
by means of a small toggle switch pro-
vided for this purpose.

Portable
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table band
s designed

Louis Allis D.C. Explosion-Proof Motor

The Louis Allis Co., Milwaukee, Wis., has placed on the market a D.C. Explosion-Proof Motor designed especially for use in gaseous mines. In this motor are incorporated 18 separate and distinct improved features, one of which is its small, compact overall dimensions, making the motor interchangeable with A.C. and D.C. NEMA frame



Louis Allis D.C. Explosion-Proof Motor

conforms with reference to NEMA dimensions D and shaft sizes. The unusually low overall height which makes it particularly adaptable for low overhead mines is said to be especially important. Because of its rugged, heavily reinforced cast-iron and steel construction, smooth, streamline shape and double protected insulation, the D.C. Explosion-Proof Motor is said to be protected from every angle to assure a long life of dependable, trouble-free performance

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April, 1939

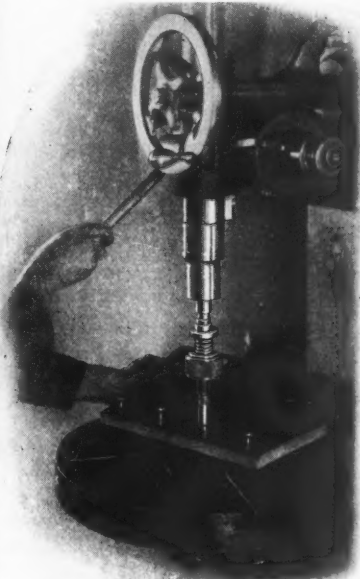
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JARVIS

TENSION ADJUSTABLE SCREW DRIVING CLUTCHES

These Tension Adjustable Screw Driving Clutches are generally used in drill presses or other stationary machines and can be furnished in various capacities up to 1" bolts, nuts and screws. They are inexpensive.

Ask for our catalog T-5.



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on the toughest jobs.

According to the manufacturer, the motor will deliver a constant, smooth flow of absolutely dependable power under the most severe mine operating conditions, and do it safely in atmospheres containing explosive dust or gases.

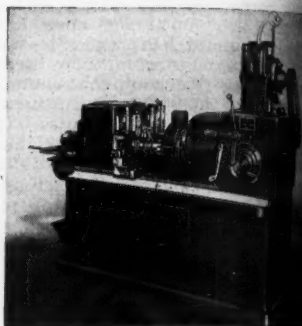
The Louis Allis D.C. Explosion-Proof Motor is available in a wide range of both electrical and mechanical modifications.

Billings Di-Matic Bar Stock Automatic Machine

To meet the demand for a fully automatic machine of simple design but suited to the rapid production of less complex parts, yet with speed and accuracy necessary in competitive production, the Billings Di-Matic, illustrated herewith, has been brought out by The Billings & Spencer Company, Hartford, Conn. The machine is said to be easy to tool up and economical to operate on short runs.

The machine has two non-indexing spindles of standard design immovably set in a heavy, rigid frame, with op-

posed adjustable taper roller in and cylindrical roller bearings in. This construction is said to allow



Billings Di-Matic Bar Stock Automatic machine shown in index position with high arm in the high speed position.

heretofore prohibitive to indexing machines.

The cross slide carries a form for each spindle, operated by a type direct-acting cam. The bed

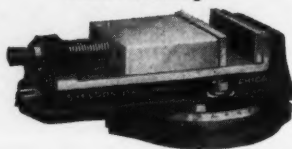
SHELDON

ARBOR PRESSES and VISES...

Sheldon ARBOR PRESSES come in 12 sizes, in capacities from $\frac{3}{4}$ to 10 tons, with Plain Levers, Hand Wheels, Ratchet Levers, or Compound leverage—with standard or special bases or platens. Each is a better press, with correctly engineered semi-steel frames that will not spring or spread and alloy steel racks and gears. All have round rams that simplify dies and jigs—round rams that hold their alignment—an exclusive SHELDON feature.

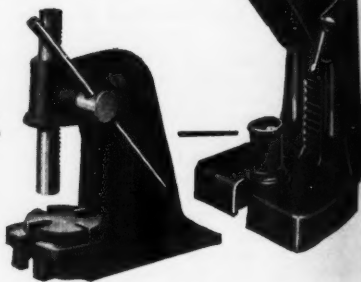
Sheldon Milling Machine, Drill Press and Shaper vises come in 5 types either plain or swivel base.

Write for Arbor Press Catalog
Lathe Catalog.



Sheldon Machine Co., Inc.

1626 N. Kilbourne Ave.,
Chicago, U. S. A.



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Automatic
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100%

April



211 PAGES

of interesting information on
Taft-Peirce Services and Products

Contract Manufacturing Service—Complete modern facilities for engineering and design, tooling and development, manufacturing, pattern work, heat-treatment, inspection.

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Magnetic Chucks—SUPERPOWER Rectangulars and Rotaries... the world's finest magnetic chucks. Magnetic V-Blocks and Parallels.

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Air Service Equipment—Boring machines for propeller hubs and air-craft parts. Propeller protractors, balancing stands, checking plates.

Now...ANOTHER PRINTING OF A VALUABLE VOLUME

Here's the 1939 edition of the Taft-Peirce Handbook... a valued right-hand aid to production executives, purchasing agents, shop foremen, master machinists. It gives complete illustrated information on the standard products and special services available through Taft-Peirce. This new printing also describes several important new Taft-Peirce products, ranging from gages to machine tools... notably a new surface grinding machine.

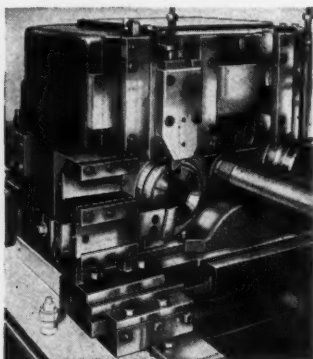
Write today on your company letterhead for your copy of this valuable volume. You will incur no obligation of any sort, of course.

The TAFT-PEIRCE

MANUFACTURING CO. • WOONSOCKET, R. I.

MODERN MACHINE SHOP 165

the cross slide is cast integrally with the headstock, making an unusually solid foundation for the forming slide.



Billings Di-Matic with collet unloaded in front spindle, showing form tool in cutting position on cross slide and cut-off tool on upper independent cut-off slide.

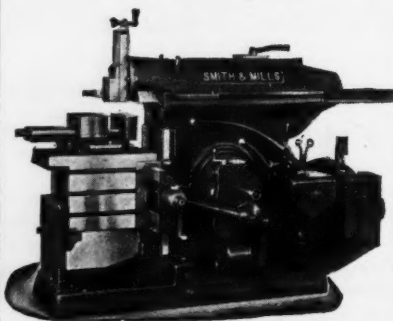
The cut-off tools can be removed from the slide without disturbing the set-up. The cross slide cam action is of un-

usual design, the single cam revolving between two rollers and thus maintaining smooth, direct action without backlash.

The turret, which has two tool positions, is a simple, cylindrical device carried in a massive housing that slides on the bed of the machine in hardened and ground steel ways. The turret is operated directly from the cams on a drum above the slide. Fitted over the main drive shaft is a torque tube which takes the place of the conventional cam shaft and controls the feed mechanism. The torque tube has a powerful planetary drive which assures smooth action. The main drive mechanism is enclosed in a sealed gear box and runs in a bath of oil. The torque tube, which is threaded, carries the stop.

The cross slide bed and headstock are cast in one piece, forming an unusually solid construction and, in conjunction with the cam and rigid guides, permits a new conception of accuracy in forming. Collets and pushers are of conventional type, cam spring fed, with their action adapted to feed through one spindle at a time alternately, during dwell in index-

SMITH & MILLS SHAPERS



Automatic lubrication—forced feed. Multiple disc clutch and brake. Quick feed changes. Direct reading feed and stroke dials. Power rapid traverse to cross feeds.

THE SMITH & MILLS CO.
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Why Use A Shaper to cut Keyways when

DAVIS KEYSEATER

will do the job so much quicker and better?

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Exchange and Glasgow Sts.
ROCHESTER, N. Y.

3 steps

TO BETTER GRINDING WHEEL PERFORMANCE

1 FRACTIONAL GRADES:

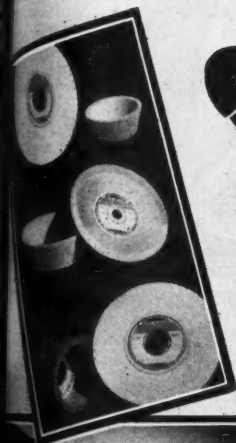
.... A choice of three degrees of hardness in a single grade. If grade K, for instance, is slightly too hard for your work it is not necessary to go to grade J ... a whole grade softer. Bay State Research Engineers can now scientifically locate the exact degree of hardness for you in the proper FRACTIONAL GRADE.

2 H9 VITRIFIED BOND:

A strong tenacious bond designed to give a cooler cut, increased wheel life, and better production.

3 CONTROLLED POROSITY:

A precise method of spacing the cutting units, assuring exact duplication.



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WESTBORO, MASSACHUSETTS



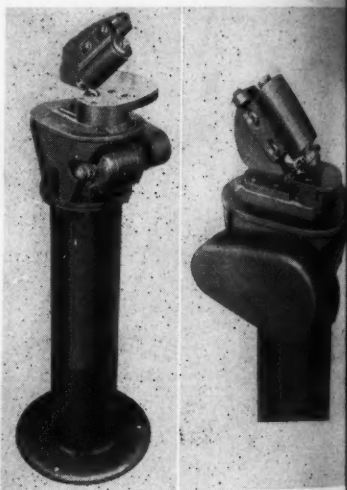
Spindle speeds and feeds are changed by the use of gears of the "pick off" type. The pulley shaft runs at a constant speed of 900 r.p.m. and spindle speeds up to 1,800 r.p.m. are available through change gears. The turret is indexed to bring the various tools to the work by a modified Geneva motion. An indexing arm swinging on a bracket over the cam drum and actuated by a cam inside the drum engages the lugs on the turret indexing disc. The turret swings 180 deg. As it reaches 90 deg. it dwells, while the collet opens, stock is fed through to stock stop, and the

collet closes, indexing is completed, turret is locked in position, and slide carries it back to the work. Positions in the turret are made for holders 2 in. in diameter. Tool holders are held securely in place by pin bolts. Provision is made to force coolant through turret tools under pressure when required.

The spindle capacity is $1\frac{1}{2}$ in. round stock; feed length, 5 in. maximum. Motor recommended, 5 h.p. Floor space required, 8 ft. 3 in. without stock support. Height, 4 ft. Weight, 6,000 pounds.

"Quickwork" Combination Throatless Shear and Flanger

The "Quickwork" Combination Throatless Shear and Flanger illustrated here with, a compact, versatile unit that



"Quickwork" Combination Throatless Shear and Flanger

handle a wide range of sheet metal fabrication, has been placed on the market by The Quickwork Company, 400 W. Madison St., Chicago, Ill. It is of simplified unit type design for maximum utility—as a shear, as a flanger, or as both, as bench-type or pedestal-mounting machine, for production shop work or as portable equipment out on the job. As a shear, it will handle all straight



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WATTS BROS. TOOL WORKS
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SPEED REDUCERS
Sizes from 1/50 to 7½ H.P.



We offer 10 different styles from which to choose the exact reducer to meet your individual requirements.

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BLOWER WHEELS—MOTOR GENERATORS

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Good Seeing



... is the vital link between good workmen and good work

Human eyes are industry's most critical control devices. For this reason, if for no other, their well-being is a matter of vital concern. Indeed, Americans can look forward with envy to the day when their homes, their schools, and their public buildings are all as well-lighted as the modern industrial working-place.

This fact will bring scant comfort to those who search for evidence that the so-called "selfish interest" of industry and the personal welfare of industrial workers are bound to be in conflict. For, clearly, the value of a sight-saving standard of seeing extends beyond mere "productive efficiency" to protect human welfare both while on the job and also after the day's work is done.

Good lighting conquers visual strain, it makes work easier, makes surroundings cheerier, and ends the nervous

tension that comes from eye-fatigue. At the end of a shift in the well-lighted plant, employees leave their work clear-eyed, visually fit for hours of recreation and home life.

In this trend to a better standard of seeing in industry, the General Electric Vapor Lamp Company has played a highly significant part. For General Electric mercury lighting, engineered by lighting specialists to the seeing tasks involved, has made it possible to provide sight-saving lighting at a cost well justified in industrial gains alone. Thus, motives of "good business" and human well-being are merged at a single goal—a clear-cut example of the fact that the profit-system points the way to a brighter future for America. General Electric Vapor Lamp Company, 897 Adams Street, Hoboken, New Jersey.

GENERAL  ELECTRIC
VAPOR LAMP COMPANY

938C

MODERN MACHINE SHOP 169

April, 1939

and irregular cutting, including full circles and curves, both concave and convex. Material of any width or length can be cut. The smooth, even action of the self-feeding rotary cutters makes it easy to follow the most intricate layouts.

A simple, quick change of heads converts the machine into a flanger which is equally simple and easy to operate. The shoulders of the flanging rolls act as a guide for the depth of flange. Attachments and rolls can also be furnished for U-ing, wiring, special flanging and forming.

The machine as furnished is arranged for two cutting and flanging speeds. It is ball bearing equipped throughout. Cutter and roll shafts have lifetime ball bearings and all of the drive mechanism runs in a bath of oil, thus reducing the lubrication job to a minimum.

Societe Genevoise Type MUL-250 Shop Gage Measuring Machine

On behalf of the Societe Genevoise D'Instruments de Physique, Triplex Machine Tool Corp., 125 Barclay St.,

New York, N. Y., is announcing a high precision measuring machine for industrial shop use to be known as the Type MUL-250. Embodied in this measuring machine are the important features of the highly accurate machines used in various bureaus of standards both in this country and throughout the world. The Type MUL-250 Measuring Machine makes possible the direct measurement inspection, and checking of all production gages to a degree of accuracy that is generally possible only in the laboratory.

Mounted on a bed of cast iron of extreme hardness is a measuring carriage which supports a divided scale measuring anvil for external measurements, dual flat feeler for internal measurements, and feeler with dial gage for measuring pitch. Guided on precision rollers which bear on the V and flat guides of the bed, the carriage is traversed by handwheel. Its displacement is rated to 0.050 in. or 1 mm. on the auxiliary scale. It is accurately positioned by means of a slow motion knob, both controls being constantly engaged. All measurements are effected under constant measuring pressure of less than one pound. The standard scale is

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the best

Bronze Metal"



20 years without
a drink

ARGUTO

OILLESS BEARING CO.

Wayne Junction, Philadelphia, Pa.



Wire-Working Machinery

Wire Mill Equipment

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in
NAME
PLATES



This machine quickly stamps details and serial numbers into name plates.

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COMPOUND DIES

Produce Accurate Parts in One Operation



ARCH TYPE

Waltham Machine Works

Massachusetts

They are most satisfactory when used in WALTHAM CYLINDRICAL SUB-PRESSES where accurate alignment is not only attained but maintained. We can furnish these Subpresses in nine diameters of plungers. The arch type is used for strip punching with or without roll feed. Use the overhang type for second operation work requiring hand positioning.

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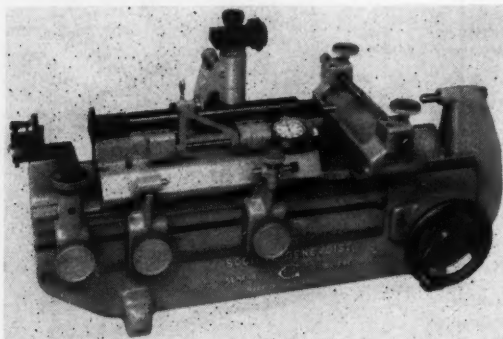
OFFERS MORE FOR
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Again Universal leads with two more improvements in their Drill Bushings. Super-Finishing the bore insures greater accuracy and vastly improves wearing qualities. The Black Dome is rust-proof and adds to the appearance of your tools.

UNIVERSAL

Engineering Company
Frankenmuth, Mich.

fitted with measuring anvils to carry out the various testing operations and moves under a micrometer microscope to permit direct readings to 0.00005 in. or 0.001 mm. Fractions of these values are easily estimated. A goniometric microscope increases the field of application of the machine; it is suited for the measurement of angles and is par-



Societe Genevoise Type MUL-250 Shop Gage Measuring Machine

ticularly useful for the examination of thread profiles.

The standard scale is graduated in twentieths of an inch or in millimeters. Its coefficient of thermal expansion is consistent with the value agreed to by I. S. A. and all national standardizing bodies so that corrections for room temperature are unnecessary. The glass which protects the scale is optically flat and has no influence on the precision of the readings. A calibration chart of the scale established to 0.00001 in. is supplied with each machine. The micrometer microscope which sights the standard scale has a magnifying power of 50X. The division of the eyepiece reads

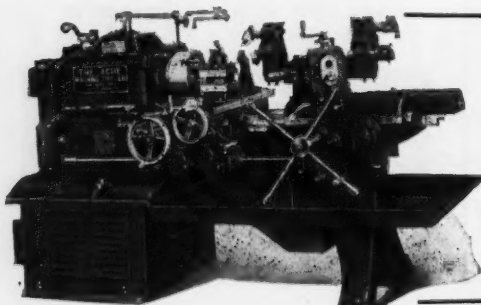
to 0.005 in. while readings to 0.00005 can be made on the divided drum. Fractions of these values being easily estimated. The illumination device comprises a 4-volt lamp with green filter.

Cylindrical parts are measured between the carriage anvil and the standard anvil, both of which are faced with tungsten carbide and impervious

wear. The floating transversal support allows for measurement between centers of parts up to 4-in. diameter. Cylindrical pieces which cannot be held between centers are measured in a measurement table mounted on the bed in place of the transversal support. This table also serves for the measurement of parts with parallel faces. Its plane is supported at three points and can be levelled by means of adjusting screws. External screw threads are measured on the transversal center support, the effective diameter being obtained by the aid of calibrated wires which serve for checking the roundness of taps. The core diameter

is measured by means of a set of prisms which can be used for all pitches larger than 25 T.P.I. Screw threads, gages, taps, screws, and similar work are held between centers on supports which are mounted on scraped ways at the front of the bed.

The goniometric microscope allows the measurement of angles on threads and for similar work. Mounted on slides with measuring screws and reading drums, it can be used in inspecting threads for the measurement of major and fillets or flats. Inclined at 20° to facilitate the observation, the goniometer head comprises two superimposed glass reticles, each provided



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The No. 4W Acme Universal Turret Lathe with its unusual high operating efficiency and simplified design, insures maximum production on all work within range. Write for circular.

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The punch was located in the die shown here by
drilling an oversize hole in the punch plate and
flowing CERROMATRIX around the punch. It is
estimated that \$15 was saved in its cost through
the use of 30 cents worth of Cerromatrix. This reg-
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Cerromatrix is reducing costs in the metalworking
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Local Associates: Mining & Chemical Products Ltd., London
Canadian Representatives: Dominion Merchants Ltd., Montreal



Photo courtesy
Motor State Products Co.

a dotted diametral line. One is fixed, while the other rotates, together with a glass circle illuminated from below and graduated in degrees. Angles are read to one minute of arc on the scale of the eyepiece of a small auxiliary reading microscope. The goniometer has fixed focusing adjusted on the plane of the centers of the work-holding supports. It can be tilted to the main helix angle of the thread to ensure maximum sharpness of the profile image. Field illumination is furnished by a small collimator with 4-volt lamp fixed to a tiltable plate supporting the microscope so as to keep the light beam centered.

The maximum measuring range between centers is 8 in. and maximum diameter accommodated, 4 in. Pitch can be checked on a maximum length of 10 in. and maximum diameter of $3\frac{1}{4}$ in. Length of bed, $32\frac{3}{4}$ in. Width of machine, $16\frac{1}{4}$ in. Total height, $18\frac{1}{2}$ in. Weight, net, with normal equipment, 216 lbs. Normal equipment includes machine with standard scale, micrometer microscope with illumination device, transversal support for measurement of diameters, two center supports, and one feeler-holding frame with dial gage for

measurement of pitch, one flat adjustable support for snap gages, one in transformer 110-125-220/4 volts. Also one reference ring $1\frac{1}{2}$ in. with calibration certificate, one 0.2 in. gage block, one slip feeler for measurement of rings, five feelers for measurement of pitch, and three supporting blocks.

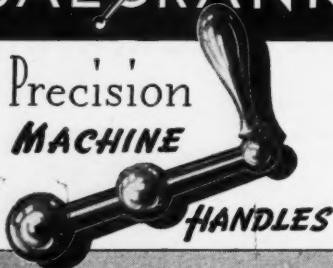
Model QR "Rockwell" Hardness Tester and Model QS "Rockwell" Superficial Hardness Tester

For jobs where hardness testing requirements call for 100 per cent production testing of parts made in large quantities, or for testing a large percentage of the products, the Model "Rockwell" Hardness Tester and Model QS "Rockwell" Superficial Hardness Tester, recently placed on the market by Wilson Mechanical Instruments Co., Inc., Concord Ave. and 14th St., New York, N. Y., are said to have many advantages without any loss of accuracy in testing.

These motorized models are made in an 8-in. vertical capacity. The readings obtained are identical with readings

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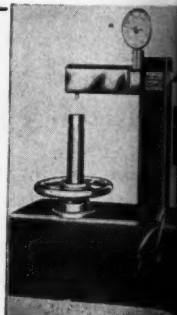
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Internal
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Model "HT"



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Direct Reading hardness numbers "C," "B," "A," etc., scale. No double-reading. Speedy, accurate operation.

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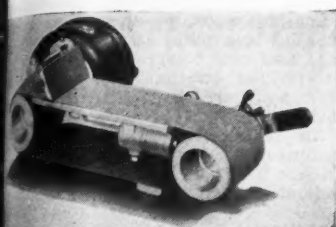
Pyro-Electro Instrument Co.
7323-5 W. Chicago Blvd., Detroit, Mich.

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ages, one b
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The Hormel-M Grinder is sturdily built with a supporting leg under the grinding wheel to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with ALEMITE LUBRICATION complete with grease gun.

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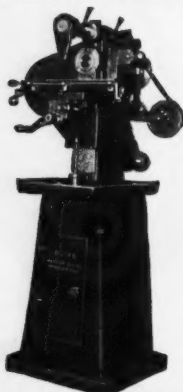
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**Improved
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Balancing
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No Leveling
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A simple and
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They are made in
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Swing	Greatest Distance Between Standards	Capacity in lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
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Four-Chilled
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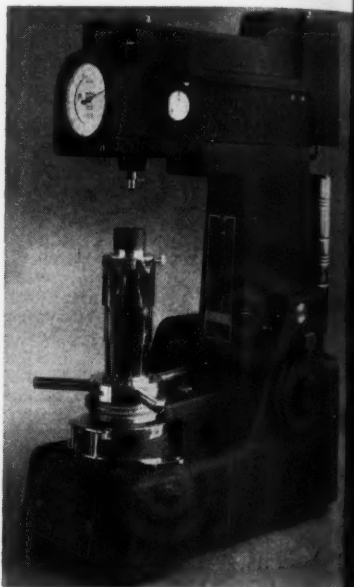
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tained on "Rockwell" hand-operated machines and the speed has been increased to a point consistent with accurate and reliable results. Specifications determined on the hand-operated models may therefore be met on these motorized testers.

An extensive study of production hardness testing with light loads as are used on the "Rockwell" test indicates conclusively that speeding



"Rockwell" Model Q Hardness Tester

the operation of the machine does not necessarily speed up in direct proportion the number of pieces that can be tested. Efficient handling of the work oftentimes can do more to increase the number of pieces tested than any amount of quickening the operation of the tester itself.

The design of the motorized "Rockwell" testers is such that no time is wasted after the material is inserted in the machine and no time is lost through idle cycles of the machine when the specimen must be placed in position with care. Readings are absolutely independent of variations in thickness of pieces tested.

There are not many applications where motorized equipment will be

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Long Length Drills
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High speed and carbon drills, taps, reamers, milling cutters, hollow mills, and mills, drill rod, die sets, etc.

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For operating single or double acting air, steam, water or oil cylinders. Made in lever, foot, solenoid and motor operated.

All pressure up to 3000 lbs. Bulletins on request.

Other Products: Arbor Presses, Flexible Couplings, Steel and Stainless Ball Floats, Steam Traps and Separators, Air Separators, Traps and Vents, Etc.

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5. Formed Tools

Instant Set-up. Will handle tools from 1/16" to 3" diameter and up to 6" in length of flute.

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BERGRAM MECHANICAL ENGINEERING CO., Inc.

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decided advantage to the user, but for such applications the Q Model "Rockwell" and "Rockwell" Superficial Hardness Testers are said to give genuine "Rockwell" numbers on a machine which conforms to the high standards of precision and accuracy that are built into the hand-operated models. With the Q Model products can be tested to the same hardness limits as previously. It is not necessary to sacrifice the quality of inspection for the sake of making more tests per day.

Pioneer Coolant and Lubricant Pumps

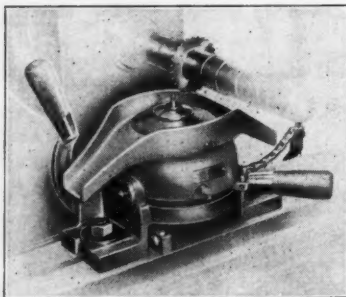
An additional series of coolant and lubricant pumps has been announced by the Pioneer Engineering & Manufacturing Company, 31 Melbourne Ave., Detroit, Mich. The units are designed especially to be used in conjunction with machine tools or auxiliary tanks where the unit must be driven with a flat or V-belt, chain, gear, or flexible coupling, or where it is impossible or impractical to mount motorized models. They are said to be particularly desirable for use on export or foreign ship-

ments where the electrical characteristics usually have a tendency to affect the motor speed and therefore the delivery of the unit. All parts are interchangeable and the entire assembly may be used in place of other standard types regularly furnished by this company.

The Model FV (Foreign Vertical) and the Model FB-V (Foreign Bracket Vertical) are designed in such a way as to be submerged directly into the tank or reservoir and to be attached to the side of the tank or machine as required. The FB-V may be suspended by the foot bracket attached to the pump, whereas the Model F-V may be mounted with the conventional brackets and flanges available for with all other types of Pioneer vertical pumps.

The Model F-VB is built for mounting on the side of a coolant tank machine pedestal for close coupled installation. No auxiliary inlet piping required.

All of the units are built in capacities up to 175 g.p.m. and pressures to 53 lbs. per square inch. The units are of the open impeller type with particular attention being paid to obtain max-



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NEW Dearborn Automatic Chucking and Indexing Fixture

Work held by draw in collets. Collets open and close automatically. Work automatically ejected. Indexes without loss of time for milling 1, 2, 3, 4, 6, 8, 12 or 24 sided pieces. Minimum set-up time required. Speeds up production. Positive and accurate in operation.

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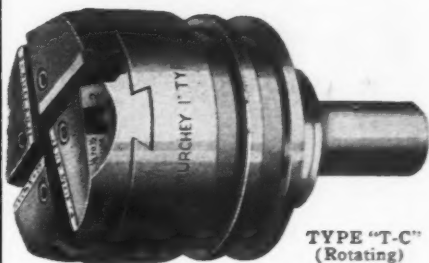
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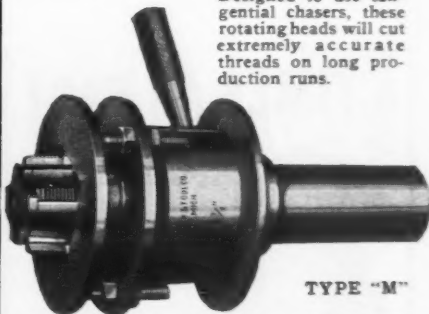


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(Rotating)

(Also in Non-Rotating Type T-G)

Tangent Chaser DIE HEADS

Designed to use tangent chasers, these rotating heads will cut extremely accurate threads on long production runs.



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Collapsible MACHINE TAPS

Universal machine taps used as a stationary tap with handle or as a rotating tap by removing handle.

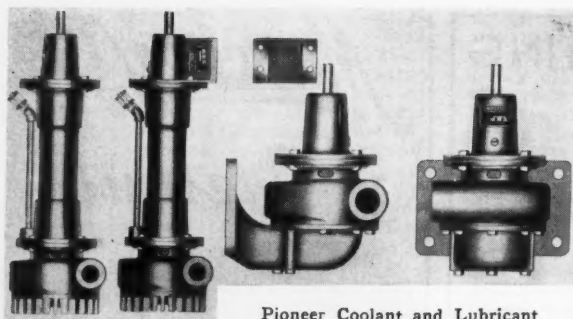
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DETROIT

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Pioneer Coolant and Lubricant Pumps

mum efficiencies and high heads, thereby permitting the use of filters. Abrasives in the liquid being pumped will not damage or impair their efficiency or life.

A special mechanical seal is used in all Pioneer pumps, so designed as to eliminate shaft friction and the need for repacking. This also eliminates the

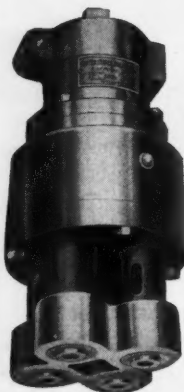
necessity for maintaining pump locations in relation to liquid level, particularly in the F-17 model. The pumps operate at motor speed or otherwise, and require no relief or by-pass valves in the delivery line to protect the pump or motor when the coolant supply is throttled.

Federal Super Sensitive Comparator

To the line of dial indicators made by Federal Products Corporation, 1144 Eddy St., Providence, R. I., has been added the Super Sensitive Comparator illustrated herewith. The indicator on this comparator is especially designed for fine sensitivity and repetition qualities. The contact point spindle is supported by a spring bellows which eliminates friction on the spindle; thus internal friction and inertia have been reduced to the minimum.

The lever at the side of the indicator

4 TIMES AS FAST



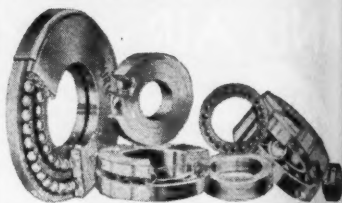
• This U. S. Multiple Drill Head drills four heads at once . . . does your drilling job 4 times as fast. With other U. S. heads, as many as 50 holes can be drilled at one time. Let us show you how to save money on special jobs.

Send blue prints for estimates.

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Auburn Special Ball Bearings are made to customer's dimensions or to answer specified service conditions. Send details of your problem and get the Auburn Answer.

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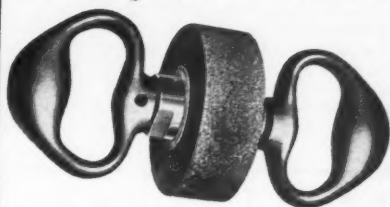
A THOR Stamp can't be beat for clear, uniform marks—for long life. They're made to give you more marks per dollar.

Made of special, correctly-heated alloy steel. Central striking point gives uniform indentation. Thumb side marking makes them easily read—easily used. Write for Catalog.

The Pittsburgh Stamp Co.

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The Desmond CRACKERJACK Grinding Wheel Dresser



The 4" dia. wheel is mounted on dust protected ball bearings with safety type handles.

It will quickly dress a square edge or bevel on your grinding wheel.

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W-3B "RACINE" Wet Cut Utility Saw,
6" Capacity.

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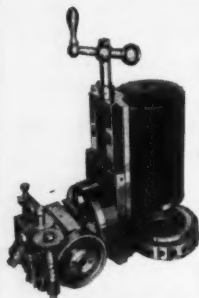
1770 State Street

Racine, Wis.

controls the fine adjustment of the contact point after the indicator has been brought to approximate position on the vertical side and clamped. The frame is designed for maximum rigidity. The instrument is exceptionally simple and practical for checking other instruments, gages, and any work which requires a high degree of fidelity.

The indicator is graduated in 0.0001 in. and the total range is 0.003 in. The dial shows plus or minus 0.0015 in. The maximum height from top of anvil clamp block to contact point is 4.488 in. and the depth from center of contact

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DRILL
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ETC.**

Will cut spur and bevel gears, milling, graduating and keyseating. A useful and convenient attachment in any shop.

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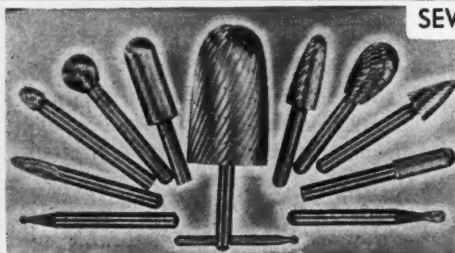
Federal Model 110B-3 Super Sensitive Comparator

point to vertical slide is 2-31/64 in. The contact point has a diamond tip. The base is 10 1/4 in. front to back and 7 1/2 in. wide. Height of column, 13 in. Weight, 35 pounds.

Landis Special Reaming and Chamfering Fixture

The Landis Machine Co., Waynesboro, Pa., announces a reaming and chamfering fixture for use in Landis 4, 6 and 8-In. Stationary Pipe Die Heads. The fixture will perform the reaming and chamfering operation, during the threading operation, on all diameters of pipe within the capacity of a head.

The Landis Special Reaming Fixture is simple in design and can be applied to any Landis Pipe Threading and Cut-



N. S.—GROUND FROM THE SOLID after hardening

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One tool engineer said: "We are just waking up; we've half a million uses for your tools." Why put up with grinding dust, hand filing, obsolete rotary filing, etc.? Let Severance Engineers survey your jobs. Our cutters have a MONEY BACK Guarantee. Another engineer writes: "I could not get a cutter to stand up until your cutter came out. (They ARE real.)".

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1516 E. GENESEE AVE. SAGINAW, MICH.


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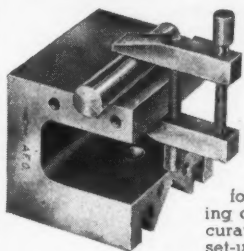


Knock-Out Abrasive Wheel Dressers

do as good a job as a diamond but cost much less to use. No pressure is necessary as best results are obtained by just touching. Dressing a wheel requires just a few seconds.

Hardened adjustable bearings last indefinitely as they are constantly lubricated by oil wick. Send for bulletin E37M.

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ABERDEEN, S. D.

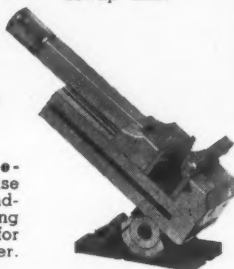


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A precision tool that holds cylindrical or flat pieces firmly for drilling, milling or grinding. Accurate . . . saves set-up time.

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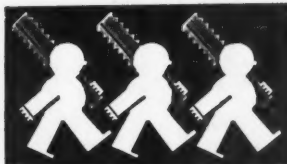
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No. 12
G. CO.
W, MICH.

April, 1939

April, 1939



Landis Special Reaming and Chamfering Fixture

ting Machine employing die heads of the above sizes. The fixture consists of a driver which is gripped in the pipe support at the rear of the crossrail, a centering ring which fits the bore of the crossrail supporting the driver in proper position, and within the driver a pres-

sure spring which exerts a force against a reaming tool holder which has a sliding fit within the bore of the driver. This assembly is held together by a draw screw which passes through the driver to the opposite end where it is adjustable to vary the spring pressure.

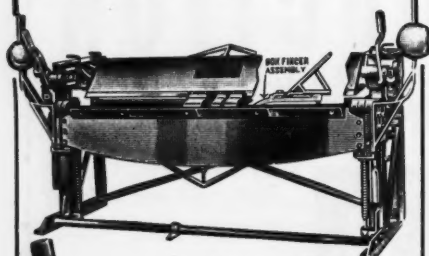
A separate reaming tool is required for each diameter of pipe. The tool is supported and locked in position in the reaming tool holder by means of a head cap screw. In order to give proper support to the reaming tool, the reaming tool holder covers only a partial rear of the head; thus, several tool holders may be required to cover the complete range of a head.

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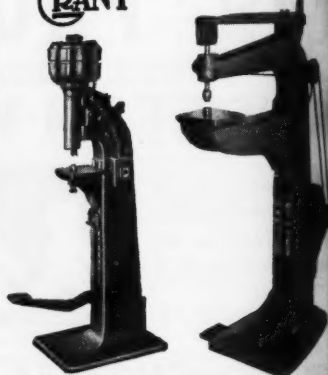
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Fig. 1334
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Fig. 1267



Fig. 1249
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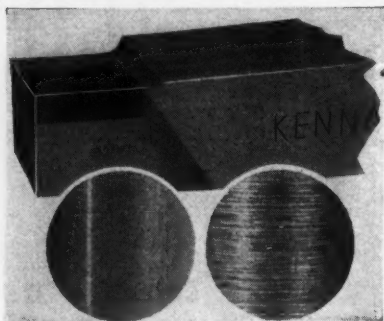
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JENKINTOWN, PENNA.

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Indianapolis Box 556 San Francisco

which the tools may be tipped by the user or in an assortment of 18 styles of Kennametal tipped tools for operations such as reaming, boring, tapping, mill-

form-tooled bar stock (magnified times) as compared with the same face as machined with a different



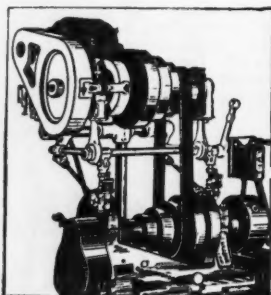
Style No. 11 Kennametal Tipped Tool and Surfaces (X3) Machined with Kennametal and with Another Tool

ing, gaging, and so on. The illustration shows the Style No. 11 tool, tipped with Kennametal, and the unretouched inserts show the smooth finish obtainable by the use of Kennametal working on

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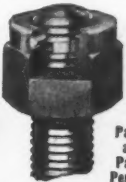


Fig. 1510

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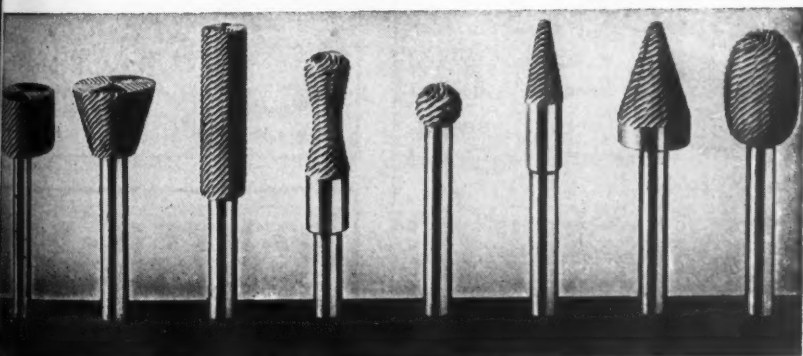
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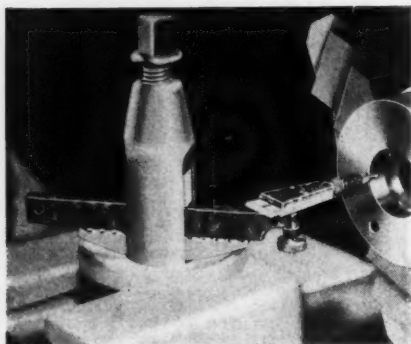
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Starrett "Universal Junior" No. 564 Indicator

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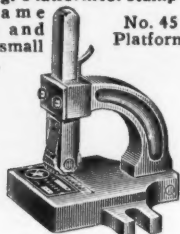
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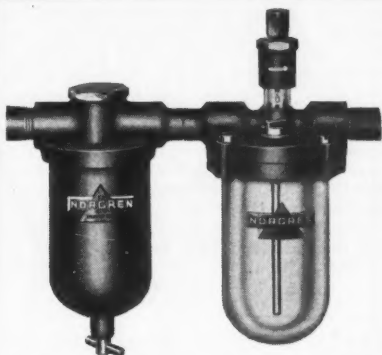
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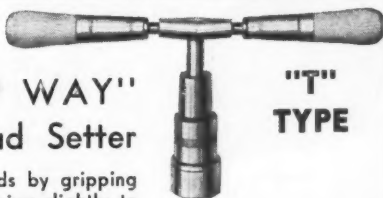
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The TITAN drives or removes studs by gripping
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practically all physical effort.

To assist in obtaining the correct spindle speeds for any type of work, the spindle speed selector dial includes



Single Lever Spindle Speed Preselector B. & O. Nos. 5 and 7 Universal Turret Lathes

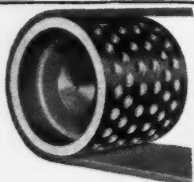
chart of cutting speeds based on the use of modern tools. A scale on the stationary cover is graduated to read surface speeds in feet per minute. On the drum is a plate which gives the spindle speed and below that is a chart showing diameters, opposite the cutting speeds. The cutting speed chart gives all the diameters corresponding to one spindle speed that fall within a definite range of surface cutting speeds; the diameters being expressed in inches and fractions. Removable clips on the dial carry numerals indicating the number and sequence of speeds desired for the operations. By placing the spindle speeds above the cutting speed chart, with figures of considerable size, they are read at a glance by the operator as he stands at operating position. This means one important thing—a quick visual check-up on whether the machine and tools are being used to full advantage.

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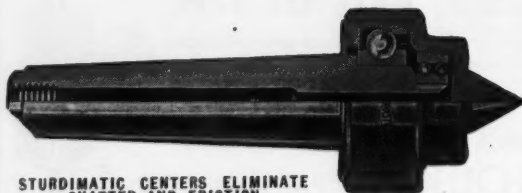
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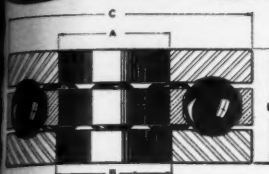
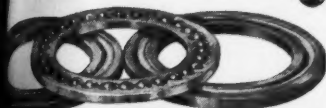
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The end of each gage is in the form



Starrett Small Hole Gage No. 829

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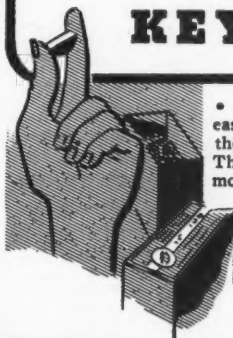
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DR-38

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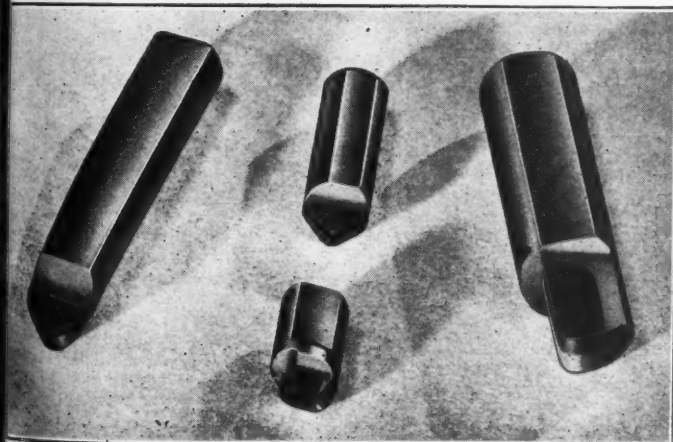
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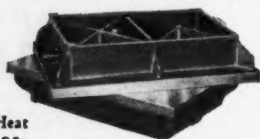
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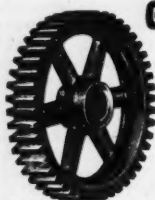
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hardening by Reed special process to insure
longest wear and best work. Send for circular.

REED SMALL TOOLS WORKS
40 Dewey Street • Worcester, Mass.

REDUCE PRODUCTION COSTS with MOTOR MICA -- a Lubricant in Powder Form

REG. U. S. PAT. OFF.

Oil-less—Greaseless—Combustion-proof—Temperature-proof—Water-proof

DEEP DRAWING — To get a
cleaner draw-
ing... to cut down metal cracking or wrink-
ling... to a minimum... to increase the number
of drawings made without re-dressing the dies;
... to add two ounces of Motor-Mica to one
ounce of your drawing solution. Works equally
well on hot or cold drawings and exceptionally
well on stainless steel. The use of Motor-Mica
... makes more continuous runs, increases pro-
duction and lowers operating costs.

Used also in Cutting Oil for turning, drilling,
milling, threading and grinding... insures
longer run per tool grind. On wire drawing it not only improves finish but increases die
life. Packed in 1 lb., 5 lb., 10 lb., 25 lb. and 50 lb. containers. 25 years of Satisfactory Service.

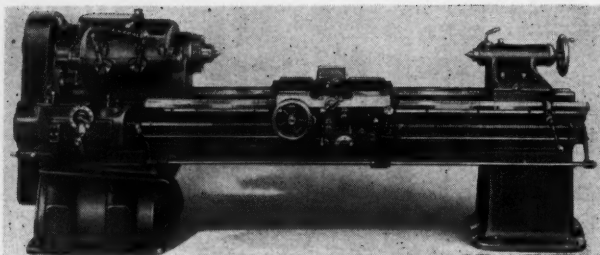
Manufactured by

SCIENTIFIC LUBRICANTS CO., 3462 N. Clark St., Chicago, U. S. A.

Distributed by

MOTOR-MICA SALES COMPANY
549 WEST WASHINGTON ST., CHICAGO

for BEARINGS — Mix with lubricants
to form a protective
coating on wearing parts to prevent bearings
from running hot... will cool hot bearings
while machines are running. Motor-Mica main-
tains a constant lubricating film... reduces
friction and heat to a minimum... for use on
heaviest machinery or most delicate mechan-
ism. Does not cake, gum, harden or dry out
... protects metal from touching metal. Pays for
itself in what it saves—a little goes a long way.



Boye & Emmes 20-In. Model C Geared Head Lathe

to 436 r.p.m. The headstock gears are both splash and cascade lubricated, and the spindle journals are lubricated by pump with filtered oil through a sight glass gage. All gears are made from individual hammered forgings, normalized, heat treated, and the teeth lapped after hardening. Shafts are all heat treated alloy steel with six integral splines. The positive jaw tooth clutches are also heat treated.

The driving motor is mounted on a hinged plate in the head end cabinet leg, which is designed to provide adequate ventilation. Power is transmitted by multiple V-belt, flat belt, or

silent chain drive with drive pulley mounted on anti-friction bearings, supported at each side the face in anti-friction journals. The driving clutch is large diameter and the multiple disc plate type.

Forty-eight feed and thread changes are available, and a convenient arrangement makes it possible

cut odd threads or coarse leads not provided for in the regular range of 1 to 32 threads. The carriage bearings on the bed consist of two 90 deg. inverted V and the flat at the front with full length scraped bearings. The carriage V's are 32 in. long.

The apron journals, bed ways, carriage cross slide, and cross feed screw journal are automatically lubricated by a pump in the apron actuated by a piston meshed with the bed rack. Drive clutch start and stop levers are located directly under the head in addition to one which is attached to and transmits motion with the apron. The distance between

BUY ECONOMY

HOLLOW SET SCREWS



SOCKET HEAD CAP SCREWS



*Try Them On Your Next Job!
Or Write For Samples Today.*

ECONOMY MACHINE PRODUCTS COMPANY

5216 Lawrence Ave., Chicago, Ill.

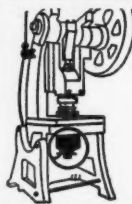


TANNEWITZ

Abrasive Cut-off Machine

Uses Abrasive Wheels, Saws, and instantly swivels and cuts any angle from 45° left to 45° right, does clean, instantaneous work on metal bars, shapes tubes.

THE TANNEWITZ WORKS
Grand Rapids, Mich.



Universal Die Casting Machine for deep drawing, forming die, pressure pad control, and blanking die stripping actions.

Write for engineering power press die booklet.

DAYTON ROGERS MFG. CO.
MINNEAPOLIS • MINNEAPOLIS

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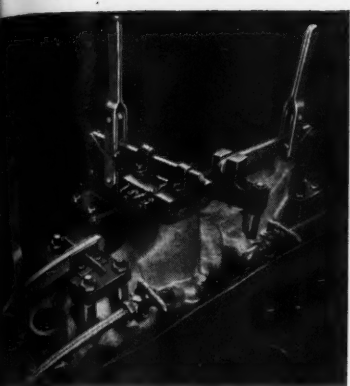
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Die Cushion
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press die
booklet.

MFG. CO.
MINNEAPOLIS



DO YOU MACHINE CASTINGS?

If you machine castings or metal parts, then you have the problem of temporarily holding the parts in fixture.

We make a complete line of quick-acting toggle clamps — nationally accepted as the modern, efficient, low-cost method of designing production checking fixture.

Used by Chrysler, Dodge, General Motors, Packard, Douglas Aircraft, Western Electric and hundreds of small shops.

Send now for De-Sta-Co Toggle Clamps new Bulletin No. 39, so as to have it before you when designing next job.

DETROIT STAMPING CO.
Established in 1915
WEST FORT ST., DETROIT, MICH.

**45% DRILL COST
SAVING!**

with
NEW
"feed-as-you-need"
CHUCK



GIVEN DEPTHS
Diagrams illustrate
"Feed-as-you-need"
combinations for ex-
acting depth require-
ments.

The outstanding tool design development of two decades. Use straight shank drills (whole or broken) — Use entire drill or any part of it for given depths — use for single or multiple operations.

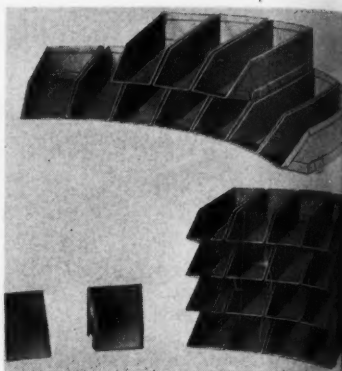
Send for detailed information
without delay.

Scully-Jones & Company
1913 S. ROCKWELL STREET, CHICAGO

centers on an 8-ft. bed length is 48 in. Domestic shipping weight for 10-ft. bed is 85 pounds.

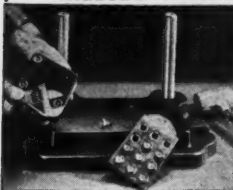
Stackbin Assembly Bin

To fill a need for a uniform stackbin assembly bin which can be used on any assembly bench, Stackbin Corporation, 53 Troy St., Providence, R. I., has designed a new bin which keeps parts always within fingertip reach. Made with a sloping floor which feeds contents toward the front, the bins can be set up in a semi-circle, and can be



Stackbin Assembly Bin

Accurate Hole Transfer Made Easy With NIELSEN TRANSFER SCREWS



Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods.

7 Sizes U. S. S.—Inexpensive — Last for years.

Write for Circular

NIELSEN TOOL & DIE COMPANY
1863 Gardner Ave. Berkley, Mich.

stacked one above the other to hold all parts within the most efficient reaching distance.

Eight inches long and 2½ inches deep these new bins are four inches wide in back and three inches wide in front. Heavy gage sheet steel and welded construction assure durability and long life.

ALL ALLOY FULLY GUARANTEED PORTABLE SHEARS



Two Sizes

No. 1 cuts up to No. 11 gauge strip or sheet. No. 2 cuts up to ¼" steel plate.

Special Blades for shearing stainless steel.

BREMIL MFG. CO.
1725 PITTSBURGH AVE. ERIE, PA.

"Sturdybender" Press

The Steelweld Machinery Sales Division of Cyril Bath & Company, 6000 W. 12th Avenue, Cleveland, Ohio, announces a new line of smaller bending presses which will be called the Sturdybender line. These machines have been developed to meet the demand for a stamp production type bending press capable of delivering sharp, accurate bends and precision in multiple operations. Sizes of the line of presses range from 10 to 100 tons, and are suitable for handling up to 10-ft. x 10-in. material.

The Sturdybender line combines

HINGES

VARIOUS WIDTHS
and GAUGES

BUTTS AND
CONTINUOUS LENGTHS

WRITE FOR PRICES

S & S MACHINE WORKS

4541 W. LAKE STREET HARDWARE DIVISION CHICAGO, ILLINOIS

For
GUARDS
CABINETS
CASES
BOXES

SEEING IS BELIEVING

When YOU see how a

WALTON TAP EXTRACTOR

Backs out broken taps
without annealing, drill-
ing or damaged threads

YOU'LL BE CONVINCED

That's why we ship on
30-days Free Trial.

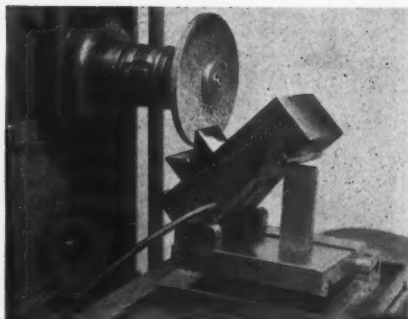
Write for Folder 132
listing sizes and prices

Each Tool Must Sell Itself

THE WALTON CO.

11 Allyn St.,

Hartford, Conn.



MAGNA-SINE Assures Accuracy

The Magna-Sine is a magnetic sine table that holds magnetic material at any required angle, single or compound, with a guaranteed accuracy of .0002".

In the "set up" shown above, precision limits were absolutely necessary. With a combination of angles of 6° and 45°, perfect results were obtained in minimum time.

Seven sizes cover all requirements.

OMER E. ROBBINS CO.

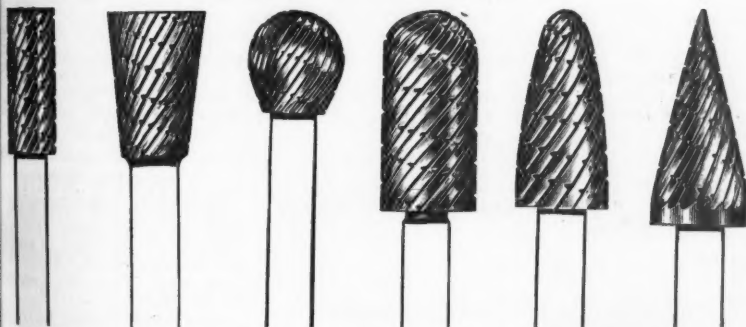
635 MT. ELLIOTT

• DETROIT, MICH.

Announcing

GROBET Rotary Files

Ground from the Solid



Ask for catalog KG, the most complete catalog of its kind, illustrating hundreds of rotary files hand cut, milled cut, ground from the solid; also diesinkers burs.

GROBET FILE CORP. OF AMERICA

**3 PARK PLACE
NEW YORK CITY**



"Sturdybender" Bending Press

outstanding features of the Steelweld Bending Press, modified for lighter work. It has a one-piece all welded frame, heavy crown, and side housings which in the larger machines are 10 in. in width, the manufacturer having found that frame stability is a first essential for sharp bends on continuous production.

The Sturdybender also has the other distinguishing features found in the Steelweld line; namely, full tapering ram with slides that are self-adjusting and self-compensating for wear, solid forged eccentrics, twin gear and double gear drive, Twin Disc clutch and brake, all

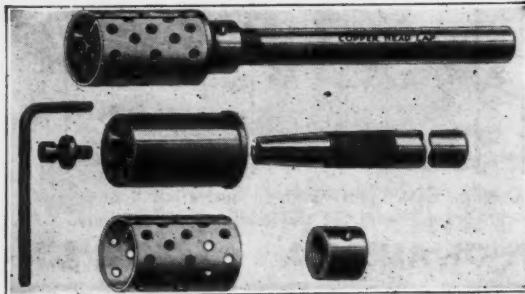
anti-friction ball or roller bearings except mains, patented unbreakable ball joints, large main and eccentric gears with bronze bushed. In addition, it has a hollow bed, and because of frame stability is ideal for multiple punching, notching and other serial or separate operations where less sturdy construction is likely to mean costly die upkeep. The bed and ram take standard brake punches and dies, and the entire machine is designed with a view of standing up to continuous production in the bending, forming, punching and shaping of lighter materials.

Leiman Dust Collector for Surface Grinders

A dust collector for continuous surface grinding operations which is said to be 99 per cent efficient has been placed on the market by Leiman Bros., Inc., 4W-1 Walker St., New York, N. Y.

The efficiency of the Leiman unit is due to the dust collecting system employed in embracing a very powerful motor-driven suction fan which draws the dust from the surface grinder through a suction hood and telescopic jointed piping and transfers it directly to a metallic cyclone of ample proportions.

The cyclone system whirls the dust with high centrifugal force and concentrates the main body of the dust mass into the cone, depositing it by means of a powerful vortex into the dust receptacle at the bottom, the dust escaping through a bag which covers



LOWER YOUR LAPPING COSTS

With Copper Head Expanding Laps. Profitably used in hundreds of leading shops. Available in sizes from $\frac{1}{8}$ " to $2\frac{1}{2}$ ", graduated by sixteenths of an inch.

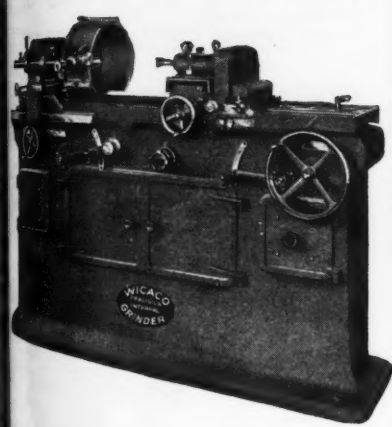
Many other designs for special applications.

Write for Bulletin

Boyar-Schultz Corporation
2120 Walnut St. Chicago, Ill.

WICACO Internal Precision GRINDER

Vibration Minimized by Underslung Drive



4 other precision features:

- Water-Cooled Wheel-Head
- Instantaneous Reverse
- Rigid Work-Head
- Positive Stop for Blind Hole Grinding

The New WICACO Precision Tool Room Grinder puts you way behind the decimal point when it comes to close tolerances.

It will pay you to investigate this machine. Write for complete facts.

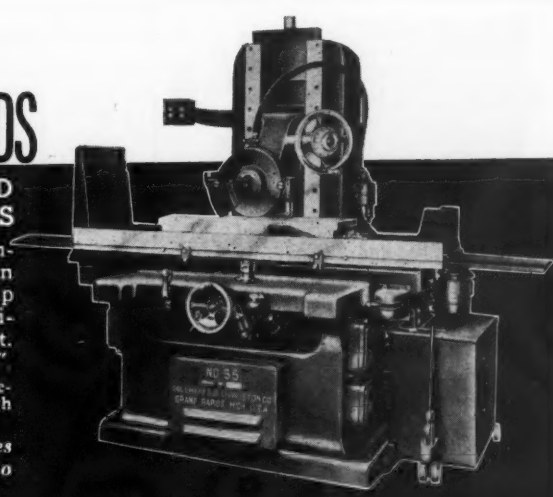
THE WICACO MACHINE CORP.
Wayne Junction • Philadelphia, Pa.
EST. 1868

Grand Rapids

HYDRAULIC FEED SURFACE GRINDERS

Improved in design to increase grinding profits in your plant. Table speeds up to 125 ft. p.m. with minimum power and wheel cost. Sizes 6" x 18" to 14" x 48". Write for catalog GL-100 describing these versatile High Speed Precision Grinders.

Production Type Machines
Available from 12" x 36" to 10" x 144".



BALLMEYER & LIVINGSTON CO. 308 STRAIGHT AVE., S. W. GRAND RAPIDS, MICH.

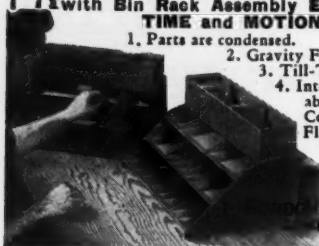
FASTER ASSEMBLY

With Bin Rack Assembly Equipment
TIME and MOTION SAVER

1. Parts are condensed.
2. Gravity Feed.
3. Tilt-Type Bins.
4. Interchangeable Bins—Complete Flexibility.

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L. HALL CO.
CONN.



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Spur, Worm,
Bevel, Helical
or Special

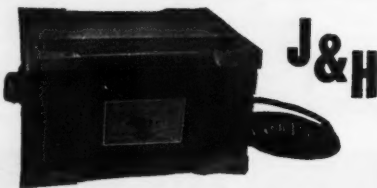
WE DO Surface Grinding, Internal and
External Grinding, Lapping, Splining and
Broaching.

We specialize in grinding hardened steel
bushings, cam rollers, etc.

25 years spent in serving the machine trade
guarantees quality work and prompt service.

**THE TAYLOR MACHINE
COMPANY**

1919 E. 61st Street Cleveland, Ohio



The Demagnetizer

For Alternating Current

The J & H Demagnetizer requires no
countershaft, belts, or other intricate
electrical connections. All that is neces-
sary is to plug it into the nearest lamp
socket or receptacle.

It is of the new Unipole type—heavy
duty—and can be supplied for either 110
or 220 volt alternating current. Size 12"
long, 9" deep, 6" high. Weight 60 lbs.

Sold On One Week's Trial

J. & H. ELECTRIC CO.

202 Richmond Street, Providence, R. I.

the top of the cyclone.

The bag restrains very fine residue of
dust, allowing only filtered air to es-
cape. The dust hood can easily be
attached to the present wheel guard
by any mechanic. The suction pipe is
provided with a telescoping feature to
permit raising and lowering of the
grinding wheel.

The Leiman Dust Collector for surface



Leiman Dust Collector for Surface Grinding

face grinding occupies 18 x 33 inches of
floor space. The standard units for
alternating current operate at 110 volts.

National Acme 1½ Single Spindle Model SM Automatic

To combine maximum production with
the advantage of a minimum of equip-
ment for the manufacturer of
blanks, bearing parts, rollers, studs,
inner races, and similar parts, the Na-
tional Acme Company, 170 East 112th
St., Cleveland, Ohio, has brought out
the 1½-In. Single Spindle Model SM
Automatic shown in the illustration.
The Model SM is equipped with three
slides of rugged design; two lower hori-
zontal and one vertical above the work
spindle. All three slides are operated
by independent cams on the end of the



CENTERLESS GRINDING
 STRAIGHT - CYLINDRICAL
 SHOULDER—PROFILE
 AND DOUBLE DIAMETERS
 All Kinds of Materials
 SCREW MACHINE PRODUCTS, HEAT-TREATED AND GROUND, IF NECESSARY
 Send Blueprints or Samples for Estimates
PORTER MACHINE COMPANY
 100 PARKER AVE. CINCINNATI, OHIO



WELSTROM
 Best Quality Eye Protectors
 Visit for New Catalog.
 (Wide Vision Ventilated Goggles)
WELSTROM MFG. CO. 645 N. Aberdeen St. CHICAGO
 No. 411



Tool Room TAPPER
Saves Time. Taps. Trouble
 The Master Tapper cuts direct labor of hand tapping by requiring one-fifth the time. Eliminates tap breakage. Uses high speed ground thread taps at lower cost than carbon taps.
 Capacity— $\frac{3}{4}$ " N.C. and N.F. Working surface 14" x 20".
 Write for bulletin.
The MASTER TAPPER Co.
 4 MAIN ST. • BELLEVILLE, N. J.

Cut Costs—Increase Profits—Use "L-W" Products

L-W INDEPENDENT LATHE CHUCKS
 Now Made in 5 Sizes

10"	...\$27.00
12"	... 31.00
14"	... 36.00
16"	... 45.00
18"	... 58.50



LWCHUCK CO.



SWIVEL MILLING MACHINE VISES
 Large, Semi-Steel, 85 lbs. Made in Two Sizes
 This large semi-steel vise which can be used plain or swivel is suitable for milling machine, drill press or shaper. Has sturdy $6\frac{1}{2}$ " steel jaws; key slots provide for attaching to machine table holding surface and jaws at right angles or parallel to table. Shipping weight 90 pounds.

$6\frac{1}{2}$ " size	...\$27.00
$4\frac{1}{2}$ " size	...\$19.50

L-W also manufactures Magnetic Chucks, Demagnetizers, Dividing Heads and Power Hack Saws.

Send for a catalog of the complete L-W line.

L-W CHUCK CO.

10 N. ST. CLAIR STREET

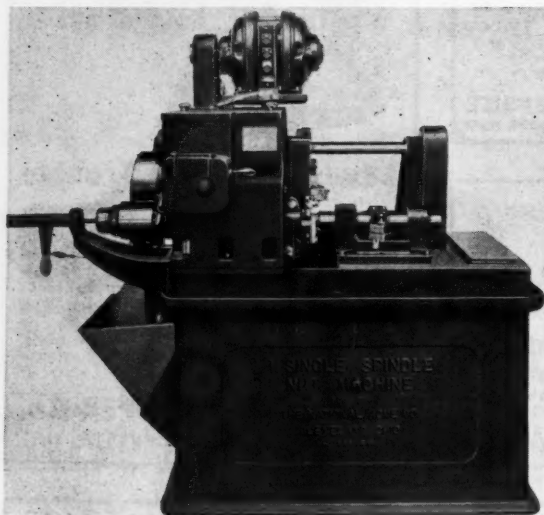
TOLEDO, OHIO

INVESTIGATE THE "L-W" LINE

main drum shaft at the front end of the gear box. Stock is fed to the spindle from a slotted stock tube, a follower being controlled by a spring-operated drum in the base of the machine. Chucking is accomplished by a finger holder and draw-in type collet. The

The front lower slide usually carries a cut-off tool, the rear lower slide usually carries the forming tool, and the vertical or upper slide serves as an auxiliary, all slides being cam-operated. All slides have independent adjustments. Feeds and speeds are controlled through pick-off change gears which are easily accessible. Drive is from a 3 h.p. motor to pulley shaft to spindle change gear shaft through spindle change gears to spindle drive shaft. The feed change gear shaft is driven by a gear on the spindle drive shaft and through feed change gears drives a small worm shaft which through a second worm shaft drives the main drum shaft. A high and low speed clutch mechanism for slow speeds and feeds is available.

The length of the stock reel is 20 ft. and the capacity of the collet is $1\frac{1}{4}$ in. round, or $1\frac{1}{8}$ in. hexagon. Standard length of feed, 24 in. Pulley speed, 770 r.p.m. Floor space required, exclusive of stock reel, 54 x 24 in. Net weight with motor, 3,050 lbs. Equipment includes the necessary change gears, cams, collet forming and cut-off tools.



National Acme $1\frac{1}{2}$ -In. Single Spindle Model SM Automatic

holder is operated by a cam on a drum on the end of the main drum shaft at the rear end of the gear box. Stock is fed against the drill when a stationary drill spindle is used or may be fed against an auxiliary stop when a rotating drill is used. The drill spindle feed is controlled by a cam and the drill spindle is returned after drilling by means of a spring.

holders, and stock stop.

Wright Speedway Electric Hoist

The Speedway, a light weight low cost wire rope electric hoist, has been added to the line of material handling equipment made by the Wright Manufacturing Company.

HIGH SPEED PRECISION GRINDERS

$\frac{1}{8}$ to $\frac{1}{2}$ H. P.

Speeds: 4,200 to 50,000 R. P. M.

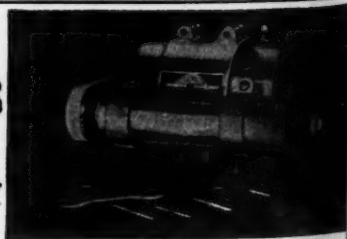
All models supplied with eccentric spindle tube which provides for manual belt adjustment. Write for details.

THE MCGONEGAL MFG. CO.

Jones Bldg.

East Rutherford, N. J.

Designed for precision bench lathes



TYPE J-15

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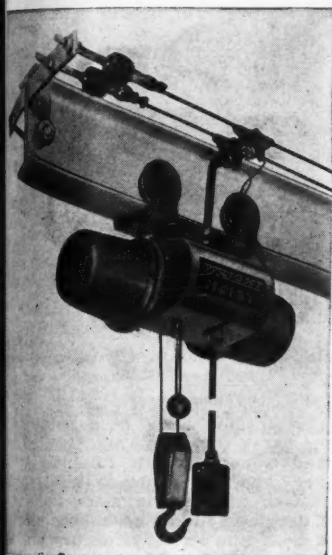
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Manufacturing Division of the American
Cable & Cable Company, Inc., York,
Pa. Hoisting capacities range from
100 to 750 lbs. and hoisting speeds from
10 to 63 ft. per minute.

The Wright Speedway Electric Hoist
standard construction includes fully en-



Wright Speedway Electric Hoist

wood ball bearing motor, anti-friction
bearings, cut alloy steel spur gears,
multiple disc solenoid brake, push but-
ton control, preformed hoisting cable,
and many other features which make it
ideal for production service.

The hoist is made in three types for
hook suspension, hook suspension, or for
mounting on a trolley.



Roller Bearing
Heavy Duty

SAVE YOUR FLOORS

RE-WHEEL YOUR
TRUCKS WITH
END-WOOD
WHEELS

Easy Rolling
Long Wearing
Sizes for all trucks.
Castors for all
purposes.

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112 Logan St. S. W.
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U. S. A.

"STACKBINS MAKE A STOCK HANDLING SYSTEM THAT CAN'T BE BEATEN"

... says large X-Ray equipment
manufacturer



The combination of portable steel **STACK-
BINS** and simple records provides a
stock-handling system which offers the
utmost in convenience, simplicity and
efficiency—the loss of expensive X-ray
parts is practically eliminated. This
manufacturer's savings are typical of
those enjoyed by hundreds of **STACK-
BIN** users.

STACKBIN sections are sturdy welded
sections containing 2 to 6 compartments
so constructed that they nest firmly into
one another. The full-view hopper fronts
keep contents from spilling and within
easy reach. Smooth interiors speed up
handling.

Whatever your storage or active stock
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BINS** worth your investigation. Write
today for complete **STACKBIN** litera-
ture giving full details and many useful
ideas. Stackbin Corp., 53 Troy St.,
Providence, R. I.

* Name on request.

STACKBINS

"STACKED AND STILL ACCESSIBLE"

Globe Neon Equipoise Dynamic Balancing Machine

To the line of Neon Dynamic Balancers built by The Globe Tool & Engineering Co., 420 Davis Ave., Dayton, Ohio, has been added a balancing machine of new type, to be known as the Neon Equipoise Dynamic Balancer. The feature of the new machine is that any unbalance in any plane selected by the operator can be completely neutralized and an accurate reading can be given

as to angle and amount of unbalance in the other plane.

In the development of balancing machines, it has been the objective of engineers to develop a machine in which the unbalance in one plane could be completely neutralized while the amount of unbalance in the other plane was being noted. To produce this result



Standard Grinders

$\frac{1}{4}$ H. P. 6" wheels to 15 H. P. 30" wheels.

DISC GRINDERS, 1 H. P. to $7\frac{1}{2}$ H. P.

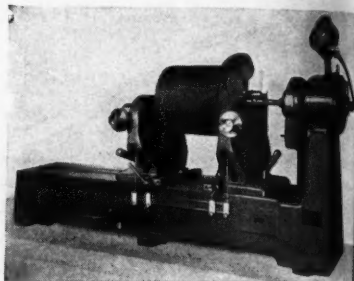
Buffing and Polishing Lathes, $\frac{1}{2}$ H. P. to 20 H. P.

VERTICAL ANGLE PLATE GRINDERS

for Planer and Boring Mill, 2 H. P. to 10 H. P.

Tool Post and Angle Plate Grinders for Lathe, Shaper, etc. $\frac{1}{4}$ H. P. to 10 H. P.

The Standard Electrical Tool Co.
8th and Evans Sts. Cincinnati, Ohio



Globe Neon Equipoise Dynamic Balancing Machine

heavy cradles have been used and in some cases the entire machine bed comprised a cradle with fulcrums applied under one correction plane. Another objective of the engineers working on the development of balancing machines has been the extreme accuracy of balance, which involves the weight ratio of the mounting of the part to be balanced to the actual part to be balanced. The lighter the saddle mounting can be made in comparison to the weight of the workpiece, the more accurate will be the ultimate results.

The design of the Neon Equipoise Dynamic Balancer is said to retain all of the good points of the previous "Y" Series machines in addition to the equipoise bar which has been added to the



LeMaire Hydraulic Feed Control Cylinders and Plain Cylinders for All Types and Sizes. Write

LeMaire Tool & Manufacturing Co.
Dearborn, Michigan



Standard Rotary Chucks

Style B (left) is ideal for work of average size and thickness. Style D (right) for thin, small work. 4 standard styles—all interchangeable.

Write for complete catalog.

O. S. WALKER CO., Inc. WORCESTER, MASS.



DIAMETERS
6" To 36"

Here's How
easy it is to firmly lock



Fig. 1434
Pat. Pending

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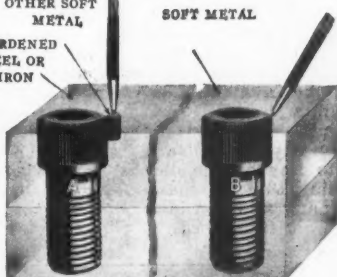
UNBRAKO

**SOCKET HEAD
CAP SCREWS**

SLUG OF
COPPER OR
OTHER SOFT
METAL

HARDENED
STEEL OR
CAST IRON

SOFT METAL



The Knurled "Unbrako" can be locked firmly in place by two simple, effective methods.

When the screw is inserted in hardened metal, the soft metal slug (as shown by "A" in the illustration) locks it securely by being spread into the knurls of the screw with the aid of a locking tool. And—in soft metal, illustration "B" shows the easy way of locking.

No other screw has all the advantages of this modern, knurled "Unbrako"!

For complete information about these and other "Unbrako" Products—get our catalog.

STANDARD PRESSED STEEL CO.

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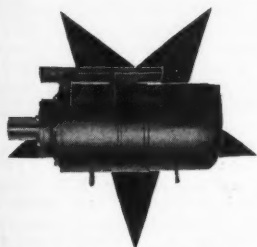
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BRANCHES

CHICAGO

ST. LOUIS

SAN FRANCISCO

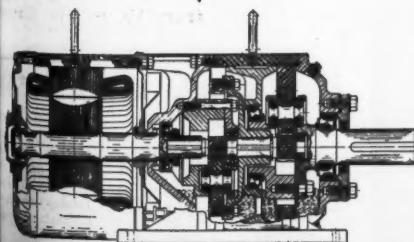


STAR

A.C. - GEAR MOTORS - D.C.

● This type STAR Gear-Motor is built in sizes from $\frac{1}{2}$ to 75 h.p.* With integral 1800 r.p.m. A.C. or D.C. motors, this type will provide output speeds between 132 and 56.5 r.p.m.* Used in many applications, such as pumps, mixers, dyeing equipment, washers, cranes, elevators, etc.*

Write for complete details and Catalog showing other styles also.



STAR ELECTRIC MOTOR CO. BLOOMFIELD
NEW JERSEY

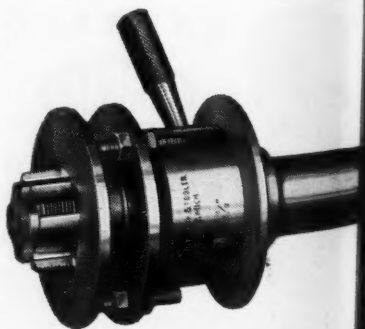
tain maximum results in reading the exact amount of unbalance at the exact angle in any plane which the operator may want to select, completely neutralizing all unbalance in the other plane regardless of its angle or amount. The machine having the equipoise feature will be available in sizes to handle weights from a few ounces to 14,000 pounds.

The new equipoise feature can be added to any of the older "N" Series dynamic balancing machines made by this company and can also be added to other dynamic balancers.

Murchey Type M Collapsible Machine Tap

A collapsible machine tap of new design for tapping straight threads is now being marketed by Murchey Machine & Tool Company, Detroit, Mich. The tap is universal in type, ready for conversion into either a rotating or stationary tap, and can be used with the handle as a non-rotating tap on turret lathes or hand screw machines or, by

removing the handle, as a rotating tap on drill presses and tapping machines. The Type M Machine Tap mechanism is fully enclosed to protect it from chips and dirt. It is of unusually sturdy construction.



Murchey Type M Collapsible Machine Tap

struction, the body being heavy and of special alloy steel with a tap nose simply large for complete chaser support. The collapsing mechanism is instantaneous in action and the chasers are instantly and positively collapsed, ensuring threads of accurate length under all conditions. Chasers are expanded or contracted by turning an adjusting screw located at the rear end of the center pin. When set, the adjusting pin may be locked to ensure that the chasers will permanently retain accurate size. This adjustment can quickly and positively be made without removing the tap from its spindle.

Chasers used in the Type M Tap are of special grade high speed steel and the bearings of the chasers are precision ground to ensure accuracy. The tap is made in 11 sizes from 1 1/4 to 4 1/2 inches with shanks from 1 1/2 to 3-in. diameter.

**MOST FOR
YOUR MONEY**

VICTOR Hack Saw Blades cut better, last longer. Now in sturdy, modern metal boxes, you gain protection for contents, easy access, aid in choosing right blade for the job—plain markings and suggestions on the box. When empty, boxes are handy for odds and ends. VICTOR Blades—Hand and Power, Tungsten and "Moly"—most for your money.

VICTOR SAW WORKS, INC.
MIDDLETOWN, N. Y.

TOOL CHESTS

that pay their way in better work and in added protection to tools. For catalog to machineists and tool makers.

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Tool Chests**

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rotating tap
g machines
mechanisms
t from chips
sturdy con



Automatic 2-point gaging to fractional ten-thousandths

Through unique self-aligning and centering features, Comtorplug "makes every man an expert gager." Direct reading enables inspectors and operators on precision bores to detect size, out-of-round, front or back taper, barrel shape, etc., to a fraction of .0001".

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THE COMTOR CO.
Waltham, Mass. • Est. 1928

Machine Tap

heavy and
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Tool Works
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SMALL GEARS

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When you buy a **RIGID**, you get a unique wrench that stays on the job, costs you next to nothing for repairs. For that housing guarantee means what it says—no bother or expense for housing repairs. But millions of users like it for other reasons, too—the adjusting nut that spins easily in all sizes, 6" to 60"; safe action replaceable chrome molybdenum jaws, handy pipe scale on hook jaw; comfort-grip I-beam alloy handle. For economy and wrench satisfaction, buy the **RIGID**—at your Supply House. **THE RIDGE TOOL CO., Elyria, Ohio**



RIGID PIPE TOOLS

Armstrong-Bray Universal Belt Cutter

Efficiency is combined with economy in the Universal Belt Cutter now being marketed by Armstrong-Bray & Co.,



Armstrong-Bray Universal Belt Cutter

304 N. Loomis St., Chicago, Ill. The cutter handles leather, fabric, and rubber belts up to 8 in. in width, and is designed to hold the belt securely against a side guide while the knife is drawn down through a track that assures an accurate, square cut. The track also prevents the knife from slipping, thus injuring the operator. Light in weight and compact, this cutter can either be bolted to a bench or carried to the job. There are no parts to wear out, and the knife blade can easily be resharpened or, if necessary, replaced at a cost of a few cents.

Motor-Mica

Motor-Mica, a powdered lubricant manufactured by Scientific Lubricants Company, 3462 N. Clark St., Chicago, Ill., is now being distributed through

the Motor-Mica Sales Company, 549 W. Washington St., Chicago, Ill. Motor-Mica is a powdered lubricant used in deep drawing, for cooling bearings, plastic and rubber molding, die casting, drilling, wire drawing, and so on.

Wilbur & Williams "Metal Dip"

A coating for new metal tools, to be known as "Metal Dip," which is said to prevent tarnishing during storage and transportation has been placed on the market by The Wilbur & Williams Company, Park Square Bldg., Boston, Mass. Metal Dip can be applied to tools made of copper, steel, brass, or any other base metal.

Metal Dip dries in approximately 30 seconds to a very thin film which completely coats the metal surface and prevents tarnishing. The coating material is colorless and practically invisible when used in a dipping bath.

Metal Dip is said to have excellent

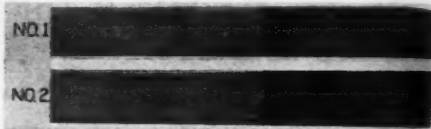


Illustration showing two bright copper strips. The left half of each strip was dipped in Metal Dip and allowed to dry for one minute in air and then exposed to chemical fumes for 24 hours. No. 1 was exposed to chlorine gas and No. 2 was exposed to hydrogen sulphide gas.

adhesion on smooth metal surfaces. It can be applied to any clean metal surface, free of dirt, grease, or oil, by dipping or spraying.

Are we using Cutting Off Tools

J. MILTON LUERS
8790 Grinnell Avenue
DETROIT • MICHIGAN

J. Milton Luers

Grobet Cylindrical Plug Gages

The Grobet File Corp. of America, 3 Park Pl., New York, N. Y., announces its new line of cylindrical plug gages for use in checking small flat drill holes. The plugs are made of high carbon tool steel and are hardened, ground and precision lapped. According to the manufacturer, the Grobet Cylindrical Plug Gages are guaranteed in accuracy to plus or minus 0.000025 in. (0.0006 mm.). A full-size plug gage is shown in the illustration herewith.

In use, the cylindrical plug gages are held in hollow hardened steel holders by collets from which they can be easily removed, reversed, or replaced. All handles of the steel holders are marked with the diameter of the gage.

Gages in diameters from 0.010 in. to



Grobet Cylindrical Plug Gage

0.004 in. in sizes graduated by 0.001 in. are maintained in stock. However, gages in sizes varying by 0.0005 in., 0.0025 in., or 0.0001 in., from 0.004 in. to 0.150 in., or in the metric system in every 1/4/100 mm. from 0.25 mm. to 4.00 mm., can be supplied by special order. Double end gages for checking tolerances can also be supplied upon special order.

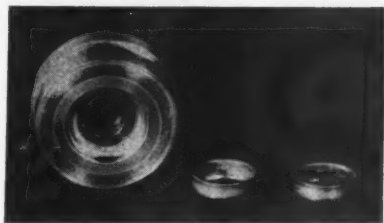
Kennametal Die Inserts

A hard carbide insert for dies used in stamping and drawing automobile parts, chair casters, bottle caps, cans, electrical appliances, wire and other metal products for home and industrial use, has been announced by McKenna Metals Co., 300 Lloyd Ave., Latrobe, Pa. Recent tests conducted by a large caster manufacturer are said to indicate that dies faced with the new material, known as Kennametal, will outlast ordinary tool steel dies many times.

In regular production runs Kennametal-faced dies stamped out 70,000 chair casters before the first regrind, as compared with a total life of 14,000 pieces for the tool steel die they had been using. While this represents an increase of 500 per cent in the number of pieces turned out, Kennametal-faced dies actually have an even greater advantage, for they may be re-

ground several times before being discarded. The die in the illustration has stamped out 11,000 casters without any visible sign of wear.

The basic ingredient of Kennametal



Die with Kennametal Insert from which 11,000 chair casters of the type shown on the right have been stamped.

alloys is an intermetallic compound of tungsten-titanium carbide, corresponding to the formula $WTiC_2$. Kennametal is claimed to be an ideal material for machine tool tips, because of its ability to machine steel heat-treated up to 500 Brinell while combining roughing and finishing in one operation, as well

TRICO

AUTOMATIC OILERS

SAVE TIME—OIL—WORRY

OPTOMATICS and LEVOMATICS maintain a constant level of oil in ring and ball bearings.

The **DRIP-DROP** is a thermal oiler dropping oil on the bearing from the top exactly as needed.

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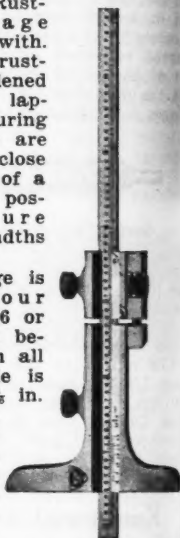
as its adaptability to the machining of softer metals. Eighteen standard styles of Kennametal-tipped tools are available, as well as three standard styles of blanks for those who braze their own tools. However, special blanks can be supplied upon request.

P. Roch No. 15 Rustless Depth Gage

Park Sales Company, 3 Park Place, New York, N. Y., is now marketing the

P. Roch No. 15 Rustless Depth Gage illustrated herewith. The blade is of rustless steel, hardened and accurately lapped at the measuring ends. The jaws are ground to very close limits. The use of a vernier makes it possible to measure depths to thousandths of an inch.

The depth gage is available in four lengths; 8, 12, 16 or 20 in., the base being 3 in. long in all cases. The blade is $\frac{1}{8}$ in. thick by $\frac{1}{8}$ in. wide. The entire instrument is finished to meet the highest requirements for tool and instrument making.



P. Roch No. 15
Rustless Depth Gage

Electronic Portable Blue Line Printer

The illustration shows a portable blue printing machine now being offered by Electronic Products Mfg. Corp., 208 W. Washington St., Ann Arbor, Michigan. The machine prints blue lines on a white background and is said to be simple and economical to operate.

The Blue Line Printer is housed in a substantially built cabinet that is finished in an attractive gun metal wrinkle finish. It operates on an ordinary power circuit of 110 volts A.C. or D.C. The light source consists of six special lamps designed for maximum illumination, etc.

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total wattage being 850. The lamps are rated for 100 hours, which permits the printing of approximately 5,000 prints.



Electronic Portable Blue Line Printer

The light is turned on and off by a "precision" micro-action switch in the door frame, assuring the use of lights only when printing. A highly polished

aluminum reflector assures uniform light distribution. The printer is furnished complete with lamps, developing cylinder, and 12 sheets of Ozalid paper.

Billings & Spencer Marketing Bemis & Call Wrenches

The Billings & Spencer Company, Hartford, Conn., has acquired the Wrench Division of the Bemis & Call Company and all of the wrench products—including the famous Coes line—formerly produced by Bemis & Call Company will be produced and marketed from the Billings & Spencer Hartford plant.

Our Error

In the announcement of the Reid Improved No. 2 Automatic Surface Grinder which was published on page 200 of the March, 1939, issue of this magazine, the spindle speed was given as 2,500 r.p.m. This should be 3,500 r.p.m.

Surface and Bench Plates

Seasoned surface and bench plates which are guaranteed by the manufac-

Machining Modern Metals Requires Modern Tool Grinding Equipment

You can materially reduce your Drill-tool and cutter costs by installing OLIVER OF ADRIAN

**Drill Grinders
Cutter Grinders
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Model 510 Drill Grinder for $\frac{1}{4}$ to 3" drills. Automatic operation—Variable clearances—Variable point angles.

Greater production, less grinding time, longer tool life assured.

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OLIVER INSTRUMENT COMPANY
430 EAST MAUMEE STREET ADRIAN, MICHIGAN

No. 15
Depth Gage

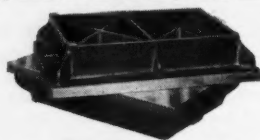
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April, 1939

MODERN MACHINE SHOP 213

turer against defects in material and workmanship have been introduced by The Master Tapper Co., 4 Main St., Belleville, N. J. The plates are available in sizes of 11 x 15, 12 x 18, 18 x 24, 24 x 24, and 24 x 36 in., and in weights



Surface and Bench Plate

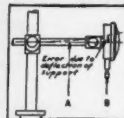
of 45 to 350 lbs. The 11 x 15-in. size is available either with a ground surface and sides unfinished, or hand scraped.



An indicator should repeatedly show the same reading for the same measurement.



Friction prevents the point from following size changes.



Too much friction at "B" causes "A" to "give."

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All sizes are available rough as they come from the planer or hand scraped.

New Literature

Troyke Rotary Tables for milling machines, slotters, die sinkers, shapers, and drilling machines, in sizes of 9, 12, 15 and 18 in., are illustrated and described in a four-page bulletin issued by Alfred A. Troyke, 219 E. Second St., Cincinnati, Ohio. Two new combination tables which may be used for plain milling and for dividing are also shown. Copy free upon request.

Skilsaw Portable Electric Tools. This 54-page book comprises a comprehensive presentation of the line of portable electric tools for production, maintenance and construction work made by Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill. Equipment illustrated and described in Catalog No. 40 includes hand saws, drills, belt sanders, disc sanders, grinders, blowers, and a floor sander. The catalog is conveniently divided into sections, a section being devoted to each of the above tools together with the accessories available for each item.

Landis No. 2 Race-A-Way Grinder. This 16-page bulletin, designated as No. RW-2 and published by the Landis Tool Company, Waynesboro, Pa., presents by means of description and photographs, the features and advantages of the Landis No. 2 Race-A-Way Grinder. Discussed in turn are the operation of the grinder, the Landis-Sizing Device, general features of design, electrical equipment and general equipment. Specifications are listed. Copy free upon request.

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Colwell Tool Post Turret. Instructions
for mounting and operating the Colwell
Tool Post Turret, product of S. G. Col-
well, 25 Congress Ave., Providence, R. I.,
are contained in a four-page folder. The
turrets can be supplied in sizes for
lathes from 9 to 18 in. Copy free.

"Hacksaw-Ology" is the title of a
booklet of helpful hints on the care and
use of hack saw blades, in which the
various types of blades are nicely illus-
trated and described. Several pages are
filled with suggestions for the proper op-
eration of hack saws for either hand or
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Simonds Saw and
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various types of
motorized speed
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A.C. and D.C. gen-
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wheels, and cus-
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Precision Meas-
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featuring the following items: New
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and Plug Gages. It contains valuable
reference tables for using gear wires,
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a table of Coefficients of Expansion,
and a reprint of the complete speci-
fications on measuring wires as set forth
in the report of the National Screw
Thread Commission. Copy free upon
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for Flexibility and Economy ... use Rotary Geared MOTORPUMPS

- flexible in installation
- save expensive power take-off



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Brown & Sharpe Mfg. Co.,
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BROWN & SHARPE PUMPS





FOR YOUR CATALOG LIBRARY

To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

- 1. Machine Shop Equipment**
New 72-page catalog No. 39, issued by Atlas Press Co., 346 N. Pitcher St., Kalamazoo, Mich., illustrates and describes the Atlas line of lathes, shapers, drill presses, vises, arbor presses, etc.
- 2. Crater Compound Booklet**
The Texas Company, 135 E. 42nd St., New York, N. Y., has issued a new 32-page booklet of practical information relating to open gear teeth and wire rope protection.
- 3. IMP Lo-Swing Lathe**
Bulletin N-29 details the improvements and refinements incorporated in the latest IMP Lo-Swing Lathe. Seneca Falls Machine Co., Seneca Falls, New York.
- 4. Sensitive Precision 10-In. Lathe**
A new catalog featuring the new Monarch 10-In. Sensitive Precision Lathe has been published by The Monarch Machine Tool Co., Sidney, Ohio.
- 5. Automatic Bar Machine**
The New RA-8 Catalog, released by National Acme Co., Cleveland, Ohio, illustrates the new design features of the Acme-Gridley 8-Spindle Automatic Bar Machine.
- 6. Tool Storage**
Lyon Metal Products, Incorporated, 1303 River St., Aurora, Ill., has issued a new, complete catalog showing Lyon Steel Tool Storage Equipment for toolroom needs.
- 7. Drill Chucks**
Folder 100, released by Scully-Jones & Co., 1913 S. Rockwell St., Chicago, Ill., illustrates, describes and lists prices on "Feed as you need" Chucks.
- 8. Torch Machine**
The Hayes Torch Machine, for cutting rolled sections in preparation for welding, is illustrated and described in a new catalog just released by Hayes Track Appliance Co., Richmond, Ind.
- 9. Grinding Wheel Data Book**
A new 112-page Grinding Wheel Data Book has been published by Abrasive Company, Tacony and Fraley Sts., Philadelphia, Pa.
- 10. Thread Tips**
Landis Machine Co., Inc., Waynesboro, Pa., is issuing a bi-monthly bulletin titled "Thread Tips."
- 11. Cemented Carbide Tools**
"Hidden Profits in Your Machine Shop" is the title of an interesting booklet available from Carboly Company, Inc., 11143 E. 8 Mile Rd., Detroit, Michigan.
- 12. Tapping Hints**
"Nevers for Tapping" is the title of an attractive, cleverly presented booklet giving valuable information for tap users. John Bath & Co., Worcester, Massachusetts.
- 13. Needle Point Diamonds**
F. F. Gilmore & Co., 112 Dartmouth St., Boston, Mass., has issued a new folder detailing Gilmore Needle Point Diamonds for truing fine grained or sharp edge grinding wheels.
- 14. Turret Lathe Tools**
Jones & Lamson Machine Co., Springfield, Vt., has issued an attractive 24-page catalog featuring tools for J & L Flat Turret Lathes.
- 15. Tungsten Carbide Tips, Tools and Dies**
A new 28-page catalog has been issued by Willey's Carbide Tool Co., Detroit, Mich. It illustrates and describes representative shapes and sizes of Willey's Tungsten Carbide Tips, Tools and Dies.

16. Airplane Tools

Available from Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., is an attractive 18-page catalog illustrating and describing applications of Chicago Pneumatic Tools especially used in the manufacture of airplanes.

17. Metal Cutting Tools

Midwest Tool and Mfg. Co., 2360 W. Jefferson Ave., Detroit, Mich., has available for tool buyers a new Metal Cutting Tool Catalog No. 16.

18. Tool Bits

A new folder describes in detail seven different types of Rex Tool Bits which are made of high speed steel. Crucible Steel Co. of America, 406 Lexington Ave., New York, N. Y.

19. High Cycle Electric Tool Facts

Rotor Air Tool Company, 17325 Euclid Ave., Cleveland, Ohio, has issued a new 32-page catalog featuring drills, screw drivers, nut setters, grinders, buffers, sanders, polishers, etc.

20. Data Book on Couplings

Ajax Flexible Coupling Co., Westfield, N. Y., has available a new data book on couplings.

21. Demagnetizers

Walker A.C. and D.C. Demagnetizers are detailed in circular K7. O. S. Walker Co., Inc., Worcester, Massachusetts.

22. Bearing Handbook

New Departure, Division General Motors Corporation, Bristol, Conn., has available for bearing buyers the latest Handbook including load ratings, dimensions, bearing fits and list prices.

23. Motor and Generator Construction Drawings

Construction drawings of motors, generators, gear units, alternators and brake motors are included in a new bulletin issued by Star Electric Motor Co., Bloomfield, N. J.

24. Bronze Bearings, Seals, etc.

"The Jewel of Metals" is the title of a booklet issued by the Frederickson Company, Saginaw, Mich., which features Sabeco Bronze bearing metal.

25. Multi-Miller

The New U. S. Multi-Miller for high-speed production on small parts is illustrated and described in new Bulletin MM-2. U. S. Tool Company, Inc., Ampere, East Orange, New Jersey.

Print plainly in filling out coupon for literature.

MODERN MACHINE SHOP

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